United States Department of Agriculture
Forest Service

Salmon-Challis National Forest Invasive Plant Treatment

Final Environmental Impact Statement

Salmon-Challis National Forest; Butte, Custer and Lemhi Counties, Idaho

November 2015

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Abstract: This Final Environmental Impact Statement (FEIS) has been prepared to disclose the environmental effects of a proposal to implement an adaptive integrated management strategy, which includes prevention, detection, control and management, and restoration and rehabilitation elements, to control or reduce the presence of invasive plants on the Salmon-Challis National Forest (SCNF). The effects of the No Action alternative are also disclosed.

The strategy proposed would be applied on the 3.1 million acres of land administered by the SCNF outside of the Frank Church-River of No Return Wilderness, of which approximately 49,000 acres are identified as being infested with invasive, non-native, and/or State-listed noxious weeds. These invasive plant infestations have a high potential to expand on lands within and adjacent to the SCNF, degrading desired plant communities and the values provided by those communities. Forest lands are also threatened by "potential invaders," invasive plants that have not been found on the SCNF but are known to occur in adjacent lands, counties, or states. Infestations can be prevented, eliminated, or controlled through the use of specific management practices. A clear and comprehensive integrated invasive plant management strategy would allow for the implementation of timely and effective invasive plant management and prevention for projects and programs in the SCNF.

Proposed control methods would be based on integrated pest management principles and methods known to be effective for each target species. They include biological control agents, such as pathogens and insects; herbicides that target specific invasive plant species; and manual and mechanical techniques, such as mowing and pulling. Control methods could be employed alone or in combination to achieve the most effective control. Treatment methods would be based on the extent, location, type, and character of an infestation and would be implemented using project design features. A maximum of 20,000 acres would be proposed for treatment annually.

Rehabilitation activities would be designed and implemented based on the conditions found in and around infested areas. Both active and passive (allowing plants on site to fill in a treated area) revegetation would be considered. Rehabilitation techniques would be assessed and implemented in order to promote native plant communities that are resistant to infestation by invasive plants.

Four action alternatives were considered. These alternatives include the Current Management Alternative; the Proposed Action (which is also the Preferred Alternative), which would utilize biological controls, aerial, aquatic, and ground-based herbicide treatment, and mechanical/manual treatment methods; the No Aerial Herbicide Application Alternative; and the No Aquatic Herbicide Application Alternative.

SUMMARY

This Final Environmental Impact Statement (FEIS) documents the analysis of the potential environmental consequences of implementing an integrated management strategy to prevent and manage invasive plants.

This FEIS has been prepared in compliance with the National Environmental Policy Act (NEPA) guidelines as set by the Council of Environmental Quality in 40 CFR 1500-1508 and Forest Service (FS) Handbook 1909.15. The document describes the purpose and need for action, the alternatives including the Proposed Action, the affected environment, and the effects of the alternatives.

Purpose and Need

The overall purpose of the proposed action is to reduce the negative effects of invasive plants on the structure and function of native plant communities and on other natural resource values that can otherwise be adversely impacted by invasive plants and to update analysis of the effects of Forestwide integrated invasive plant management. The proposal is in response to an underlying need to implement policy and direction provided at the National, Regional, State, and Forest levels, which includes control and containment of invasive plants on the Salmon-Challis National Forest (SCNF) (Executive Order 13112 - Invasive Species, 2004 National Invasive Species Strategy and Implementation Plan, 2008-2012 National Invasive Species Management Plan, 2009 Intermountain Region Invasive Species Management Strategy, Idaho Invasive Species Strategic Plan 2012-2016, 2005 Idaho Strategic Plan for Managing Noxious and Invasive Weeds, 1987 Challis National Forest Land and Resource Management Plan, 1988 Salmon National Forest Land and Resource Management Plan).

The need of the proposed action is multifaceted:

Invasive plants are diminishing the natural resource values of the Forest.

Forest resources are negatively impacted by existing and expanding invasive plant species populations. These species are known to out-compete native plants, which can result in reduced productivity and biodiversity, habitat loss, and associated economic impacts.

There must be a timely response to new infestations, new invasive plant species, and landscape scale disturbances.

In the SCNF, landscape level tree mortality and disturbance from insects and wildfires have increased and are likely to continue to increase the potential for invasive plant infestations. The Forest needs the flexibility to treat expanded and/or newly identified infestations in a timely manner. Existing decisions for invasive plant management on the Forest do not address new species or provide priorities for managing new infestations. Updating these decisions would allow the Forest to satisfy the need to incorporate early detection and rapid response into the invasive plant management program.

Existing invasive plant populations in the Salmon-Challis National Forest require active and adaptive management.

Invasive plant infestations already exist throughout the SCNF and without management will increase in density and distribution. Active and adaptive integrated pest management is necessary to contain invasive plants within existing boundaries, reduce infestation densities, and retard the establishment of new infestations. Control efforts should be focused on infestations that can realize the greatest resource benefits – those with the highest risk of spread, those that have not become established, and those that have the best likelihood of success of control. New analysis and planning is needed to make available the most current tools and guide their best use.

Rehabilitation of degraded landscapes can inhibit the spread and establishment of invasive plants.

Appropriate rehabilitation efforts are a critical component of a fully functional invasive plant management program. The goals of rehabilitating degraded areas may include preventing new infestations, preventing the reoccurrence of eradicated infestations, and/or reducing the density and spread of existing infestations. Post-fire rehabilitation efforts may incorporate one or more of the established control techniques outlined in the Proposed Action.

Federal, State, and Forest Service laws, regulation, policy and direction relating to invasive plant management must be implemented and followed.

Implementing invasive species laws and policies requires aggressive invasive plant management. This analysis would identify the strategies that the SCNF would use to comply with laws and policies pertaining to invasive plant management.

The Proposed Action

The proposal is to implement adaptive and integrated invasive plant management on current and potential infested areas outside of the Frank Church-River of No Return Wilderness (FCRONR) Area. Management activities would include inventory and assessment designed to support Early Detection Rapid Response (EDRR), control methods, implementation and effectiveness monitoring, and rehabilitation. Activities would be implemented with partners at the federal, state, and local level where opportunities exist.

To provide for EDRR, the Forest would design a plan that allows treatment of invasive plant infestations located outside of currently identified infested areas. Infestations outside of currently identified areas may include new sites that arise in the future, or sites that currently exist, but have not been identified in Forest inventories to date. The intent of EDRR is to allow timely control, so that new infestations can be treated when they are small, preventing establishment and spread, while reducing the costs and potential side effects of treatment. Planning for EDRR includes analysis for the risk for new invasions associated with the characteristics of the species and areas in the Forest where new invasions are likely to occur.

Proposed control methods would be based on integrated pest management principles and methods known to be effective for each target species. They include, but are not limited to, biological control, such as pathogens and insects, chemical control using herbicides that target invasive plant species, and manual and mechanical techniques, such as cutting and pulling. Control methods would be employed alone or in combination to achieve the most effective control. Treatment methods would be based on the extent, location, type, and character of an infestation and would be implemented using design criteria. A maximum of 20,000 acres would be proposed for treatment annually; 2,000 acres each for biocontrol and manual/mechanical treatment and 16,000 for chemical treatment.

Management priority would be based on risk factors such as the number and size of known infestations, vectors for spread, proximity to susceptible habitat, and ability to outcompete desirable plant species. The priority of species to be treated would vary based on these factors and could change over time. These priorities would be used to guide selection of specific management activities for particular infestations.

Rehabilitation and restoration cultural actions would be designed and implemented based on the conditions found in and around infested areas. Both active and passive (allowing plants on site to fill in a treated area) revegetation would be considered. Rehabilitation techniques would be assessed and implemented in order to promote native plant communities that are resistant to infestation by invasive plants. See Chapter 2 for a detailed description of alternatives.

Decision to be Made

The Responsible Official is the Salmon-Challis National Forest Supervisor, who will make the following decisions based on the interdisciplinary analysis:

- Whether to select the proposed invasive plant treatments with any modifications from public scoping or comments or as described in an alternative.
- Which project design features are needed.
- What monitoring is required.

The Forest Supervisor will base the decision on how well the alternative meets the purpose and need for action, as indicated by:

- Whether the alternative includes treatment of newly discovered infestations.
- Percentage of known treatment land base where effective treatments are available.
- Treatment cost and efficiency.
- The degree to which the alternative minimizes potential adverse impacts to human. health and the environment, based on issue indicators shown below.

Public Involvement

The Notice of Intent (NOI) was published in the Federal Register on June 23, 2011. The NOI asked for public comment on the proposal until August 2011. As part of the public involvement process, the agency sent a detailed proposed action to an extensive mailing list via mail and email, and placed press releases in the Challis Messenger, Salmon Recorder Herald, and the Arco Advertiser on April 19, 2012 with a website and contact information.

SCNF personnel met with the Shoshone-Bannock tribe in Challis, Idaho on May 3, 2012 and at Fort Hall, Idaho on June 11, 2012 to discuss the proposed project. The project was published in the July 2011 Schedule of Proposed Actions.

The Notice of Availability (NOA) for the Draft EIS was published in the Federal Register on Februaruy 13, 2015. The public comment period extended to March 30, 2015. The NOA and links to the DEIS were sent to an extensive mailing list via mail and email. A legal notice was published in the

newspaper of record, the Salmon Recorder Herald, and press releases were published in the Challis Messenger and the Arco Advertiser on February 19, 2015.

Key Issues

Seven organizations and individuals provided comment letters during scoping, all of which are located in the project record. Comments were analyzed, and public issues were identified based on these scoping comments. Many important public issues are addressed through the design of the Proposed Action. An example is human health, an issue of great public concern. All alternatives avoid the type of herbicide use associated with harmful exposures to workers and/or the public. The issue of human health is discussed throughout this document because it is of such great importance to the public, but is not the basis for alternative comparison because all alternatives equally address this issue.

The Forest Service separated the issues into two groups: significant and non-significant issues. Significant issues were defined as those directly or indirectly caused by implementing the proposed action. Non-significant issues were identified as those: 1) outside the scope of the proposed action; 2) already decided by law, regulation, Forest Plan, or other higher level decision; 3) irrelevant to the decision to be made; or 4) conjectural and not supported by scientific or factual evidence. The Council on Environmental Quality (CEQ) NEPA regulations explain this delineation in Sec. 1501.7, "…identify and eliminate from detailed study the issues which are not significant or which have been covered by prior environmental review (Sec. 1506.3)" These issues are identified in the issue analysis form which is located in the project record.

The Forest Service identified the following issues from public comments received during scoping as well as those identified internally:

Vegetation

Invasive plant treatments have the potential to impact both native plant communities and invasive plant infestations in the project area.

Soil and Water

The use of herbicides in riparian areas has the potential to adversely impact water quality. Herbicides could pollute water and affect source water protection areas. There may be potential adverse effects of herbicide treatment on soils and potential for leaching into ground water.

Fisheries

The use of herbicides in riparian areas has the potential to adversely impact water quality and aquatic species. Herbicides could contaminate water, harm fish through exposure to chemicals, and negatively affect aquatic plants and insects.

Wildlife

Herbicide exposure, resulting from herbicide toxicity, may cause harm to terrestrial wildlife species.

Sensitive Plants

Herbicide exposure, resulting from herbicide drift, residue, or direct application, may cause harm to non-target plants.

Human Health

The potential toxicity of herbicides and exposure to herbicides may have human health consequences.

Recreation

Invasive plant infestation and treatment methods could negatively affect recreationalists' experiences.

Economic Efficiency

Economic efficiency of treatment methods should be considered in the analysis.

Description of Alternatives

Alternative 1-No Action

This alternative is required by regulation (40 CFR 1502.14) and would call for no invasive plant management treatments applied to any non-wilderness National Forest System (NFS) lands, except for those NFS lands under road right-of-way (ROW) agreements with the different counties within the SCNF. In these situations, the authority to undertake treatments is vested in those agencies. The alternative provides a baseline for comparison and analysis of effects.

There would be no biological control, herbicide application, mechanical methods (hand or tool grubbing, mowing), or revegetation. Existing biological controls would progress naturally, but no supplementation would occur. Ongoing invasive plant prevention and education would continue, but additional measures would not.

Alternative 2-Current Action

The Current Action alternative includes an array of standard invasive plant management practices: information and education programs, cooperative partnerships and coordination, inventory and early detection, control methods, restoration and revegetation, where appropriate, monitoring to track treatment effectiveness, and a broad range of Best Management Practices (BMPs) and design criteria.

National Forests are directed to implement an invasive species systems approach per nationally established program components. However, the current invasive plant management program does not contain a fully adaptive invasive species systems approach (USDA Forest Service 2013). The lack of a forest-wide strategy for invasive species affects the ability to capture funding, to identify risk for invasion and spread, to fully respond to EDRR needs, and to adequately address the size and density of larger infestations for which treatment is being deferred.

The SCNF invasive plant prevention plan is located in Appendix C, however, the practices in the plan are not part of the FEIS analysis.

Treatment Methods

The current invasive plant management program utilizes a variety of tools, used alone or in combination, to treat invasive plants on the SCNF. Treatment methods include the following:

- Biological control through the use of predators, parasites, and pathogens.
- Herbicide control using ground-based spot and broadcast application methods.
- Mechanical and manual methods, such as hand pulling, mowing, cutting or torching.
- Rehabilitation and restoration methods such as seeding sites to improve competition or prevent establishment of non-native invasive plant species.

Table S-1: Average Acres Treated Annually by Treatment Method[1]

Treatment Method	Acres
Biological Control[2]	365 acres
Mechanical Control	40 acres[3]
Herbicide Control	5,977 acres

[1] Based on 2010- 2012 three-year average from Forest Activity Tracking System (FACTS) database
[2] See Appendix A for list of species
[3] This figure displays in FACTS as very low because mechanical treatments are not consistently entered into the FACTS database

Herbicide formulations, active ingredients and application rates currently in use in the SCNF are displayed in Table S-3. The range of application rates for each chemical is derived from Human Health and Ecological Risk Assessments and the herbicide label. The table displays typical application rates, but based on circumstances, herbicides may be applied at maximum application rates.
Section 7 of the Endangered Species Act consultation regarding the current invasive plant treatment was completed with the regulatory agencies (NMFS and USFWS) in June 2012. The Biological Opinion received from the NMFS specified that no more than 5,500 acres would have herbicide applied annually and no more than 550 acres of those acres would be chemically treated within 100 feet of live water. The last three-year average has been 1,077 acres of applied herbicide, with 389 of those acres being less than 100 feet from water.

Alternative 3-Proposed Action

The proposed action is to prevent the establishment of new invasive plant species, prevent further spread of existing invasive plant species, and maintain native plant communities. The proposed action would implement an adaptive integrated weed management (IWM) strategy to eradicate or control existing or newly discovered invasive plants over the next ten to fifteen years as budgets allow. The IWM strategy is derived from the Forest Service National Strategic Framework for Invasive Species Management (2013), Forest Service National Strategy and Implementation Plan for Invasive Species Management (2004), Strategy for Noxious and Nonnative Invasive Plant Management (USDA Forest Service 1998a), and the Forest Service Invasive Species Management Manual (FSM 2900), all of which direct National Forests to implement adaptive integrated weed management programs with the following nationally established program components.

Prevention

Prevention is the "first line of defense" and is a crucial element of IWM. The goal is to prevent the introduction and establishment of new invasive plant species. External and internal education and outreach is essential. A variety of educational materials such as signage, exhibits, presentations, and workshops would be used by the Forest and cooperative partners to raise public awareness of invasive plants and the ecological and economic damage created by their establishment and spread. Internal training would be used to educate personnel to recognize invasive plant species, understand vectors and preventive measures, incorporate preventive measures into the project design of all projects and activities, follow procedures for reporting and mapping invasive plant infestations, and communicate with other programs and agencies. This is a non-treatment aspect of the IWM approach. The SCNF invasive plant prevention plan is located in Appendix C; however, the practices in the plan are not part of the FEIS analysis.

Early Detection/Rapid Response

Early Detection and Rapid Response (EDRR) is a critical component of an IWM program. As new invasive plant infestations are detected, a quick and coordinated inventory and eradication response would reduce negative environmental and economic impacts.

EDRR is intended to find new invasive plant infestations at the earliest stages of invasion resulting in decreased control costs and the need for repeated treatments. New invasive species may not be listed as a noxious on the statewide list; however, these plants are identified on statewide watch or EDRR lists.

The Proposed Action includes new national direction on the control of new detections. Invasive plant sites that are discovered subsequent to the current invasive plant inventory would be evaluated to determine that the eradication treatments and environmental impacts are consistent with those analyzed in this FEIS.

Control and Management

The integrated and adaptive invasive plant management strategy proposed would facilitate the use of a variety of treatment options and combinations intended to minimize the effect of invasive plants and limit their spread.

Control techniques include manual/mechanical, chemical, and biological methods. Areas infested by invasive plants on the SCNF may exhibit a wide range of site conditions. Effective control relies on a clear understanding of the target species: its biology, the ecosystem it has infested, associated introduction pathways, and effective control methods. Control often requires repeat treatments and monitoring of control efficacy.

A variety of treatment options and combinations that could be applied to a wide range of site conditions are necessary so that flexibility is provided to increase effectiveness, reduce cost, and minimize potential for adverse effects from treatments. As monitoring identifies the effectiveness of treatments, specific control measures are adjusted.

The proposed action identifies the treatment of up to 20,000 acres of invasive plants annually. This number exceeds the current budget allocated for treatments, but is intended to be robust enough

to address both known and future invasive plant infestations. The control and management aspect of the IWM strategy is the focus of the analysis in this FEIS.

Rehabilitation and Restoration

Ultimately, the goal for invasive plant management efforts is to restore and maintain healthy native or desired plant communities that are resistant to invasive plant establishment, which recover quickly from disturbances, and provide ecosystem functionality. Many invasive plant-infested plant communities are able to successfully re-establish without intervention after control efforts. However, sites that are severely damaged or at which few desirable species remain may not be able to recover without help.

Rehabilitation and restoration are vital components of an adaptive IWM program. Rehabilitation is defined as short-term mitigation to ensure minimum site stability and functionality. This may include site preparation and seeding of desirable vegetation. Restoration is a long-term objective and involves returning sites to natural functions and native species.

Monitoring

Monitoring is a necessary part of implementing an adaptive IWM program. Monitoring provides the data for adaptive management. Information collected from monitoring may be used by managers to evaluate the efficacy of prevention, EDRR, treatment, and rehabilitation and restoration actions. There are two basic types of monitoring essential to an adaptive integrated weed management plan: implementation monitoring and effectiveness monitoring. Implementation monitoring answers the question, “Did we do what we said we would do?” and effectiveness monitoring answers the questions, “Were prevention, treatment and restoration actions effective?” and “Were intended goals accomplished?”.

Managers may use monitoring data from one site or set of sites to predict the effects of similar actions on other parts of the project area. This information can be used to promote the use of the most effective techniques for prevention, detection, treatment, and restoration, and avoid the use of ineffective methods.

Treatment Methods

The proposed adaptive IWM program would utilize a variety of tools, used alone or in combination, to treat invasive plants on the SCNF. Proposed treatment methods include the following:

- Biological control through the use of predators, parasites, and pathogens.
- Herbicide control using ground-based application methods.
- Herbicide control using helicopter aerial application methods.
- Herbicide control using aquatic application methods.
- Manual and mechanical methods, such as hand pulling, mowing, cutting, or torching.
- Rehabilitation and restoration methods such as seeding sites to improve competition or prevent establishment of non-native invasive plant species.

Table S-2: Maximum Acres to be Treated Annually by Treatment Method

Treatment Method	Maximum Acres Treated[1]
Biological Control	2,000
Mechanical Control	2,000
Herbicide Control	16,000
• Ground Application	8,000
• Aerial Application	8,000
• Aquatic Application	Unknown as there are no infestations at present

[1]See Table 2-11 for complete description

The treatments would abide by design criteria, the purpose of which is to reduce or eliminate the potential adverse impacts of the various invasive plant treatments. Design criteria are a set of required implementation features applied to projects to ensure that the project is conducted according to environmental standards and that adverse effects are within the scope of those predicted in this FEIS. Implementation of the design criteria is mandatory. The effectiveness of the design criteria is addressed throughout Chapter 3.

Herbicide Application

Four types of herbicide application would be used:

- Spot spraying-This method targets individual plants and the immediate area around them. Most spot spraying is usually done with a backpack sprayer. However, spot spraying may also be applied using a hose from a truck-mounted or OHV-mounted tank, or tanks mounted on pack animals. This is the most common herbicide application method.
- Broadcast-Herbicide is applied to cover an area of ground rather than individual plants. This method may employ a spray system mounted on a truck or OHV. Broadcast applications are used in areas where invasive plants occupy a large percentage of plant cover on the site, making spot spraying impractical.
- Aquatic application-This application method would be used in response to EDRR associated with aquatic invasive plant species. This method may employ spot or broadcast spray over the surface of or into water. Application methods may be from shore using use backpacks, truck-mounted or OHV-mounted tank, or from boats.
- Aerial application-This method would be used in areas where physical features, such as topography, restricted access, size and/or rate of spread of infestation, personnel safety, or other factors such as prohibitive unit cost of ground application occur. Invasive plants would be treated with herbicides through the use of helicopters.

Herbicide formulations and mixtures could contain one or more of the active ingredients, displayed in Table 2-10. The range of application rates for each chemical is derived from Human Health and Ecological Risk Assessments and the herbicide label. Additional herbicides may be added in the future at either the Forest Plan or project level through appropriate risk analysis, NEPA procedures, and ESA consultation (discussed in the adaptive management section).

Table S-3. Herbicides and Application Settings Currently Used and Proposed for Use

Herbicide (Active Ingredient)[1]	Maximum Label Application Rate (AI[2] or AE[3]/AC[4])	Typical SCNF Application Rate (lbs. AI or AE/AC)	Application Setting			
			Upland	Riparian	Aerial	Aquatic
2,4-D amine	2.0 lbs ae /ac/app[5] 2 apps per year	0.5-2.0 lb./ac	X	X		
Aminopyralid	**0.11 lbs ae/ac/year**	**0.06 – 0.11 lb./ac**	**X**	**X**	**X**	
Chlorsulfuron	2.6 oz. product/ac/year (0.12 lbs ai/ac/year)	0.5 - 2.0 oz./ac (0.02 - 0.09 lb./ac)	X	X	**X**	
Clopyralid	0.5 lbs ae/ac/year	0.28 - 0.5 lb./ac	X	X	**X**	
Dicamba	1.0 lbs ae/ac/app 2 apps per year	0.75 - 2.0 lb./ac	X			
Glyphosate	1.7 lbs ae/ac/app ≤ 8.0 lbs ae/ac/year	0.35 -5.0 lb./ac	X	X		**X**
Imazapic	0.19 lbs ai/ac/year	0.1 - 0.19 lb./ac	X	X	**X**	
Imazapyr	**1.5 lbs ae/ac/year**	**0.5-1.0 lb./ac**	**X**	**X**		**X**
Imazamox	**0.5 lbs ae/ac/year**	**0.25-0.5 lb./ac**		**X**		**X**
Metsulfuron-methyl	4.0 oz. product/ac/year (0.15 lbs ai/ac/year)	1.0 - 3.0 oz./ac (0.04 - 0.11 lb./ac)	X	X	**X**	
Picloram	1.0 lbs ai/ac/year	0.5 - 0.75 lb./ac	X		**X**	
Sulfometuron methyl	8.0 oz. product/ac/year (0.37 lbs ai/ac/year)	2.0 - 6.0 oz./ac (0.09- 0.28 lb./ac)	X	X	**X**	
Triclopyr: triethylamine salt (TEA)	9.0 lbs ae/ac/year	4.5 - 6.0 lb./ac	X	X		**X**

[1]Herbicides and application settings in bold are specific to the Proposed Action Alternative
[2]AI=Active Ingredient [3]AE=Acid Equivalent [4]AC=Acre [5]app=Application

Alternative 4- No Aerial Herbicide Application

This alternative is identical to the Proposed Action alternative with the exception that there would be no aerial application of herbicides. All design criteria, except those specific to aerial application, would apply to this alternative.

Alternative 5- No Aquatic Herbicide Application

This alternative is identical to the Proposed Action alternative with the exception that there would be no aquatic application of herbicides. All design criteria, except those specific to aquatic herbicide application, would apply to this alternative.

Comparison of Alternatives

Table 2-11 shows the difference of treatment methods and acres treated between alternatives. Measurement indicators specific to different resources are discussed in the Environmental Consequences section in Chapter 3.

Table S-4. Invasive Plant Treatment FEIS Alternative Comparison

	Alt. 1 No Action	Alt. 2 Current Action	Alt. 3 Proposed Action	Alt. 4 No Aerial Herbicide Application	Alt. 5 No Aquatic Herbicide Application
% of Project Area proposed for annual treated acres	0	Not specified	0.006	0.006	0.006
% of Project Area proposed for annual applied acres	0	0.002	0.004	0.002	0.004
Treatment Method					
Bio-control	No	Yes	Yes	Yes	Yes
Treated Acres	0	400[2]	2,000	2,000	2,000
# Releases	0	80	400	400	400
Chemical	No	Yes	Yes	Yes	Yes
Treated Acres	0	Not specified	16,000	16,000	16,000
# of Herbicides	0	10	13	13	13
Ground Application	No	Yes	Yes	Yes	Yes
Treated Acres	0	Not specified	8,000	16,000	16,000
Applied Acres	0	5,500[4]	3,200[3]	6,400[3]	3,200[4]
Aerial Application	No	No	Yes	No	Yes
Treated Acres	0	0	8,000	0	8,000
Applied Acres	0	0	8,000	0	8,000
Aquatic Application	No	No	Yes	Yes	No
Applied Acres	0	0	TBD	TBD	0
Total Herbicide Applied Acres		5,500	11,200	6,400	11,200
Mechanical/Manual	No	Yes	Yes	Yes	Yes
Treated Acres	0	40[5]	2,000	2,000	2,000

[1]All numbers represent the maximum annual amount
[2]These are the average acres; there is no identified upper bound
[3] How acres derived:

- Aerial application=broadcast application: treated acres=applied acres (assume 100% of treated area has herbicide applied).
- Ground application= broadcast and spot application (assume 40% of treated area has herbicide applied).
- Proposed Action:
  - No more than 50% of treated acres will use aerial application (8,000 acres= treated and applied)
  - Remaining 8,000 acres would have 3,200 applied acres (8,000*0.4)
  - Total applied acres: 8,000+3,200=11,200
  - Any portion of the applied aerial acres not utilized could be used for applied ground acres (i.e. if 4,000 acres aerially applied=8,800 applied acres; if 2,000 acres aerially applied = 7,600 applied acres; if 0 acres aerially applied = 6,400 applied acres)
- No Aerial:
  - Applied acres: 6,400 (16,000*0.4)

[4] Specified in NMFS 2012 Biological Opinion
[5] Not specified, but not prohibited.

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Chapter 1. Purpose and Need for Action

1.1. Introduction

The Forest Service has prepared this Final Environmental Impact Statement in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. This Final Environmental Impact Statement (FEIS) discloses the direct, indirect, and cumulative environmental impacts that would result from the proposed action and alternatives. The document is organized into four chapters:

Chapter 1. Purpose and Need for Action: The chapter includes information on the history of the project proposal, the purpose of and need for the project, and the agency's proposal for achieving that purpose and need. This section also details how the Forest Service informed the public of the proposal and how the public responded.

Chapter 2. Alternatives, including the Proposed Action: This chapter provides a more detailed description of the agency's proposed action as well as alternative methods for achieving the stated purpose. These alternatives were developed based on significant issues raised by the public and other agencies. This discussion also includes design criteria. This section provides a summary table of the environmental consequences associated with each alternative.

Chapter 3. Affected Environment and Environmental Consequences: This chapter describes the direct and indirect impacts, commitment of resources, and cumulative effects associated with the Alternatives.

Chapter 4. List of Preparers, Glossary, Index, and Reference Cited: This chapter provides a list of preparers, glossary of terms used, an index that provides page numbers by document type, and literature citations used throughout the FEIS.

Appendices: The appendices provide more detailed information to support the analyses presented in the environmental impact statement.

Additional documentation, including more detailed analyses of project-area resources, may be found in the project planning record located at the Salmon-Challis National Forest Supervisor's Office in Salmon, Idaho.

1.2. Background

This Final Environmental Impact Statement (FEIS) has been prepared to disclose the environmental effects of a proposal to implement an adaptive integrated management strategy, which includes prevention, detection, control and management, and restoration and rehabilitation elements, to control or reduce the presence of invasive plants on the Salmon-Challis National Forest (SCNF). The effects of the No Action alternative are also disclosed. The strategy proposed would be applied on lands administered by the SCNF outside of the Frank Church-River of No Return Wilderness Area. The SCNF encompasses 3.1 million non-wilderness acres in central Idaho within Custer, Lemhi, and Butte Counties and is comprised of six Ranger Districts: Challis-Yankee Fork, Middle Fork, Lost River, Leadore, Salmon-Cobalt, and North Fork. The SCNF shares boundaries with the Boise, Sawtooth, Bitterroot, and Caribou-Targee National Forests, Bureau of Land Management (BLM), State of Idaho, and private lands. For invasive

plant management purposes, the forest has been divided into five Invasive Plant Management Zones to help make determinations of treatment objectives and priorities. Zones assist managers by grouping geographic areas with similar habitat conditions and invasive plant management concerns. The zones are Lemhi, North Salmon, Pahsimeroi/Lost, Salmon and Upper Salmon (Map 1-1).

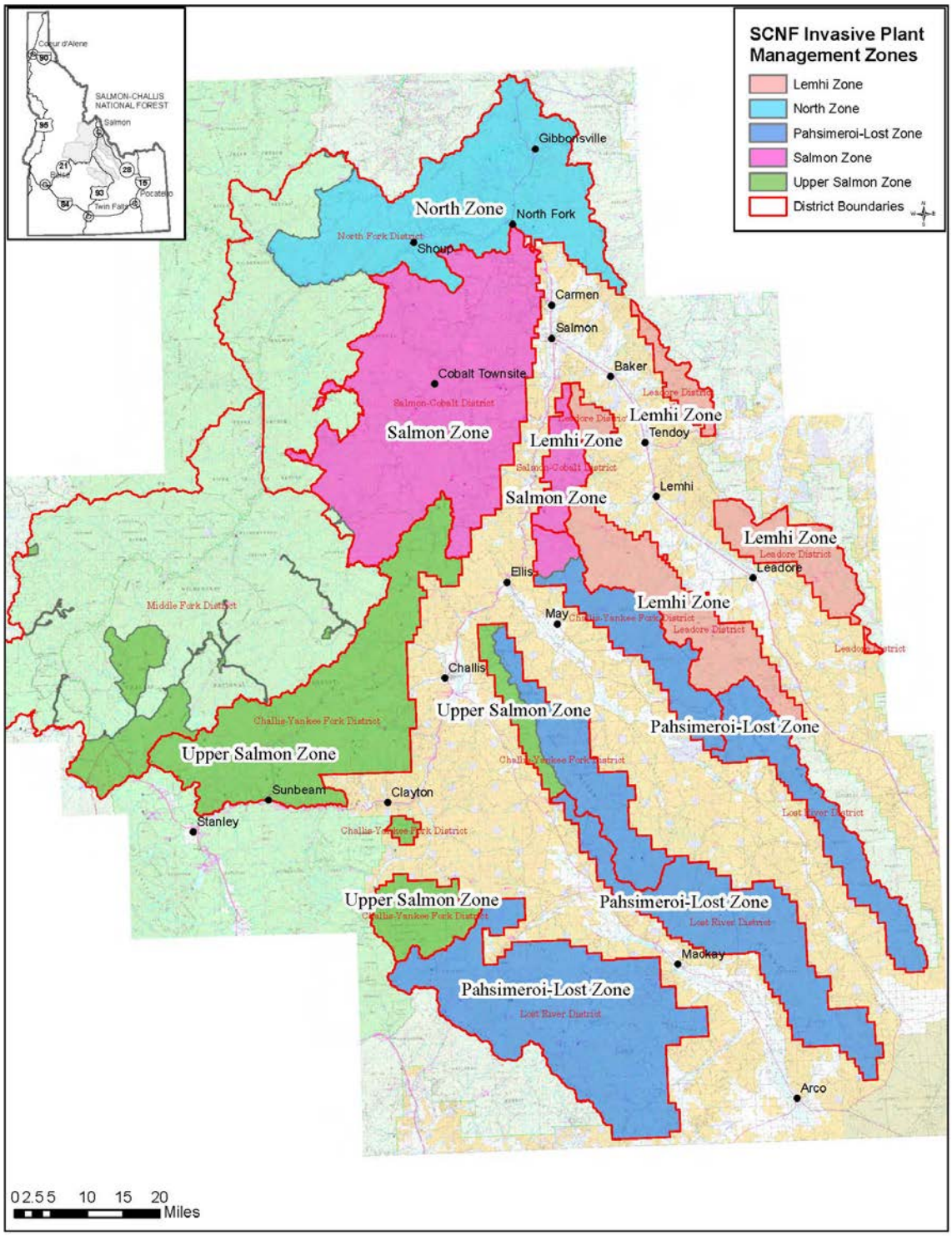
Invasive plants are defined as "a non-native plant whose introduction does or is likely to cause economic or environmental harm or harm to human health" (EO 13112). Invasive plants have been identified as a major threat to the biological diversity and ecological integrity within and outside the SCNF. Invasive plants create many adverse environmental effects, including, but not limited to: displacement of native plants; reduction in functionality of habitat and forage for wildlife and livestock; threats to populations of threatened, endangered and sensitive species; alteration of physical and biological properties of soil, including productivity; changes to the intensity and frequency of fires; and loss of recreational opportunities.

A noxious weed is a subset of the broader invasive plants category. The term "noxious weed" means any plant or plant product that can directly or indirectly injure or cause damage to crops (including nursery stock or plant products), livestock, poultry, or other interests of agriculture, irrigation, navigation, the natural resources of the United States, the public health, or the environment. The term typically describes species of plants that have been determined to be undesirable or injurious in some capacity. Federal noxious weeds are regulated by USDA-Animal and Plant Health Inspection Service under the Plant Protection Act of 2000 (FSM 2900). In the state of Idaho, noxious weeds are designated by the director of the Department of Agriculture (ID Statute 22-2402).

Within the portion of the SCNF being analyzed in this FEIS, there are approximately 49,000 acres identified as being infested with State and County listed noxious weeds. These invasive plant infestations have a high potential to expand on lands within and adjacent to the SCNF, degrading desired plant communities and the values provided by those communities. Forest lands are also threatened by "potential invaders," invasive plants that have not been found in the SCNF but are known to occur in adjacent lands, counties, or states. Infestations can be prevented, eliminated, or controlled through the use of specific management practices. A clear and comprehensive integrated invasive plant management strategy would allow for the implementation of timely and effective invasive plant management and prevention for projects and programs in the SCNF. In the absence of an aggressive invasive plant management program, the number, density, and distribution of invasive plants on the Forest would continue to increase.

The proposal is to treat invasive plants annually with an effective, integrated combination of treatments including biological, manual and mechanical, chemical (herbicide), and restoration methods (competitive seeding and planting). The project is anticipated to last 10 to 15 years or until conditions substantially change.

Map 1-1: Invasive Plant Management Zones in the Salmon-Challis National Forest



Targeted Invasive Species

Twenty-three state and county-listed noxious weed species are known to occur in the planning area to date. Some species occur across the planning area, while others are localized (Table 1-1). Treatment would not be limited to the species shown in the table. If infestations of new invasive plant species are discovered, they would be treated with one or more of the methods described in this document. Species that do not currently occur in the SCNF, but are on the Early Detection and Rapid Response (EDRR) watch list are identified in Appendix A.

Thousands of acres of common, invasive plants, such as cheatgrass, which are not identified by the state of Idaho as being noxious, are known to occur on the Forest. Treatment activities would be prioritized for noxious weed species. However, sites may be treated for other invasive plant species, especially if they are associated with noxious weeds, within the scope of this program. Additionally, these species may be included in restoration treatment plans, such as post-fire or mine reclamation. Whether the focus of treatment or not, these invasive species will not be evaluated as non-target species to protect.

The acre figures shown in Table 1-1 contain duplicate acreage. The Forest Service Natural Resource Information System (NRIS) database protocols require that a site-identified invasive plant infestation may consist of only one species. When more than one invasive plant species occupies a site (e.g. spotted knapweed and hoary alyssum), two infestations are recorded in the NRIS database; one for each species of invasive plant present, which results in a double count of acres. The total acreage of inventoried infestations in Table 1-1 is an over-estimate.

Acres of infestations by invasive plant zones are available in Table 1-1 and displayed in Maps A1 through A5 (located in appendix). Maps A1 through A5 display known infestations of noxious weeds by invasive plant management zone.

Table 1-1: Inventoried Noxious Weed Infestations by Invasive Plant Management Zone

Noxious Weed	# of Infestations	Total Infested Acres	Lemhi Zone Acres	North Zone Acres	Pahsimeroi -Lost Zone Acres	Salmon Zone Acres	Upper Salmon Zone Acres
Russian Knapweed	2	0.2	0	0.1	0.1	0	0
Hoary Alyssum	311	2,176	0.5	1,078	0	1,097	0
Whitetop	34	49	9	0.3	38	2	0
Musk Thistle	255	1,782	629	22	932	178	19
Diffuse Knapweed	12	4	0	0.2	4	0.2	0
Spotted Knapweed	1,539	39,205	1,733	21,460	405	14,237	1,369
Rush Skeletonweed	281	345	0.2	137	1	110	95
Oxeye Daisy	55	218	0	120	0	3	94
Canada Thistle	393	2,642	316	112	1,898	216	98
Field Bindweed	3	0.6	0	0	0.2	0	0.4
Houndstongue	233	795	71	529	0.9	122	7
Leafy Spurge	459	865	76	75	695	16	1

Noxious Weed	# of Infestations	Total Infested Acres	Lemhi Zone Acres	North Zone Acres	Pahsimeroi -Lost Zone Acres	Salmon Zone Acres	Upper Salmon Zone Acres
Black Henbane	67	284	30	12	236	5	0
Common St. John's Wort	6	2	0	2	0	0	0
Dyer's Woad	1	0	Eradicated	Eradicated	0	0	0
Perennial Pepperweed	2	0.2	0	0	0	0	0
Dalmatian Toadflax	32	123	0	0.2	81	41	0
Yellow Toadflax	115	373	0	37	35	18	281
Scotch Thistle	2	0.2	0.2	0	0	0	0
Knotweed	6	0.9	0	0.9	0	0	0
Sulphur Cinquefoil	130	278	10	222	0	42	2
Saltcedar	4	0.5	0	0.1	0	0.4	0
Puncturevine	9	3	0	3	0	0.1	0
Grand Total	**3,951**	**49,153**	**2,879**	**23,881**	**4,329**	**16,093**	**1,971**

1.3. Purpose and Need for Action

The overall purpose of the proposed action is to reduce the negative effects of invasive plants on the structure and function of native plant communities and on other natural resource values that can otherwise be adversely impacted by invasive plants and to update analysis of the effects of Forestwide integrated invasive plant management. The proposal is in response to an underlying need to implement policy and direction provided at the National, Regional, State, and Forest levels, which includes control and containment of invasive plants on the Salmon-Challis National Forest (Executive Order 13112 - Invasive Species, 2004 National Invasive Species Strategy and Implementation Plan, 2008-2012 National Invasive Species Management Plan, 2009 Intermountain Region Invasive Species Management Strategy, Idaho Invasive Species Strategic Plan 2012-2016, 2005 Idaho Strategic Plan for Managing Noxious and Invasive Weeds, 1987 Challis National Forest Land and Resource Management Plan, 1988 Salmon National Forest Land and Resource Management Plan).

The need of the proposed action is multifaceted:

Invasive plants are diminishing the natural resource values of the Forest.

Forest resources are negatively impacted by existing and expanding invasive plant species populations. These species are known to out-compete native plants, which can result in reduced productivity and biodiversity, habitat loss, and associated economic impacts.

There must be a timely response to new infestations, new invasive plant species, and landscape scale disturbances.

On the Salmon-Challis National Forest, landscape level tree mortality and disturbance from insects and wildfires have increased and are likely to continue to increase the potential for invasive plant infestations. The Forest needs the flexibility to treat expanded and/or newly identified infestations in a timely manner. Existing decisions for invasive plant management on the Forest do not address new species or provide priorities for managing new infestations. Updating these decisions would allow the Forest to satisfy the need to incorporate early detection and rapid response into the invasive plant management program.

Existing invasive plant populations on the Salmon-Challis National Forest require active and adaptive management.

Invasive plant infestations already exist throughout the Salmon-Challis National Forest (SCNF) and without management will increase in density and distribution. Active and adaptive integrated pest management is necessary to contain invasive plants within existing boundaries, reduce infestation densities, and retard the establishment of new infestations. Control efforts should be focused on infestations that can realize the greatest resource benefits – those with the highest risk of spread, those that have not become established, and those that have the best likelihood of success of control. New analysis and planning is needed to make available the most current tools and guide their best use.

Rehabilitation of degraded landscapes can inhibit the spread and establishment of invasive plants.

Appropriate rehabilitation efforts are a critical component of a fully functional invasive plant management program. The goals of rehabilitating degraded areas may include preventing new infestations, preventing the reoccurrence of eradicated infestations, and/or reducing the density and spread of existing infestations. Post-fire rehabilitation efforts may incorporate one or more of the established control techniques outlined in the Proposed Action.

Federal, State, and Forest Service laws, regulation, policy and direction relating to invasive plant management must be implemented and followed.

Implementing invasive species laws and policies requires aggressive invasive plant management. This analysis would identify the strategies that the SCNF would use to comply with laws and policies pertaining to invasive plant management.

1.4. Proposed Action

The SCNF proposes to implement adaptive and integrated invasive plant management on current and potential infested areas outside of the Frank Church-River of No Return Wilderness (FC-RONR) Area. Management activities would include inventory and assessment designed to support Early Detection Rapid Response (EDRR), control methods, implementation and effectiveness monitoring, and rehabilitation. Activities would be implemented with partners at the federal, state, and local level where opportunities exist.

To provide for EDRR, the Forest would design a plan that allows treatment of invasive plant infestations located outside of currently identified infested areas. Infestations outside of currently identified areas may include new sites that arise in the future, or sites that currently exist, but have not been identified in Forest inventories to date. The intent of EDRR is to allow timely control, so that new infestations can be treated when they are small, preventing establishment and spread, while reducing the costs and potential side effects of treatment.

Planning for EDRR includes analysis for the risk for new invasions associated with the characteristics of the species and areas in the Forest where new invasions are likely to occur.

Proposed control methods would be based on integrated pest management principles and methods known to be effective for each target species. They include, but are not limited to, biological control, such as pathogens and insects, chemical control using herbicides that target invasive plant species, and manual and mechanical techniques, such as cutting and pulling. . Control methods would be employed alone or in combination to achieve the most effective control. Treatment methods would be based on the extent, location, type, and character of an infestation and would be implemented using design criteria. A maximum of 20,000 acres would be proposed for treatment annually; 2,000 acres each for biocontrol and manual/mechanical treatment and 16,000 for chemical treatment. Management priority would be based on risk factors such as the number and size of known infestations, vectors for spread, proximity to susceptible habitat, and ability to outcompete desirable plant species. The priority of species to be treated would vary based on these factors and could change over time. These priorities would be used to guide selection of specific management activities for particular infestations.

Rehabilitation and restoration cultural actions would be designed and implemented based on the conditions found in and around infested areas. Both active and passive (allowing plants on site to fill in a treated area) revegetation would be considered. Rehabilitation techniques would be assessed and implemented in order to promote native plant communities that are resistant to infestation by invasive plants. See Chapter 2 for a detailed description of alternatives.

1.5. Management Direction

This FEIS process and documentation has been completed according to direction contained in the National Forest Management Act (NFMA) (PL 94-588), the National Environmental Policy Act (NEPA) (PL 91-190), the Federal Land Policy and Management Act (FLPMA) (PL 94-579), Clean Water Act, as amended (CWA) (PL 92-500, PL 95-217, and PL 100-4), the Clean Air Act, as amended (PL 101-549), the Endangered Species Act (ESA) (PL 93-205), the Wild and Scenic Rivers Act, as amended (PL 90-542), the Idaho Roadless Rule (36 CFR 294), Federal Actions to Address Environmental Justice to Minority Populations and Low-Income Populations (Executive Order 12898), Consultation and Coordination with Indian Tribal Governments (EO 13175), the National Historic Preservation Act, as amended (PL 89-665), Planning for Federal Sustainability in the Next Decade (EO 13693), and the Council on Environmental Quality regulations which provide general land management and environmental analysis direction.

Other Federal laws include:

- The Carlson-Foley Act of 1968 (PL 90-583), which authorizes and directs federal agencies to permit control of noxious plants by state and local governments on a reimbursement basis in connection with similar weed control programs carried out on adjacent nonfederal land;
- the Plant Protection Act (PL 106-224) which consolidates and modernizes all major statues pertaining to management and control of noxious weeds;
- the Noxious Weed Control and Eradication Act of 2004 (PL 108-412) which provides financial and technical assistance to control or eradicate noxious weeds;

- 36 CFR Subpart A, Section 222.8, which directs the Forest Service to cooperate with local weed control districts to develop control programs where there are National Forests and Grasslands; and
- Executive Order 13112 (1999), which directs federal agencies to:
    - develop and coordinate a management program for control of undesirable plants which are noxious, harmful, injurious, poisonous, or toxic on Federal lands under the agency's jurisdiction,
    - establish and adequately fund the program, to complete and implement cooperative agreements and/or memorandums, and
    - establish Integrated Weed Management to control or contain species identified and targeted under cooperative agreements and/or memorandums.

The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) (1947) established the US system of pesticide regulation to protect applicators, consumers and the environment. The Environmental Protection Agency (EPA) and the appropriate environmental agencies of the respective states administer the FIFRA. The FIFRA requires registration for all herbicides, after extensive testing to evaluate whether a pesticide has the potential to cause adverse effects on humans, wildlife, fish, and plants, including endangered species and non-target organisms, as well as possible contamination of surface water or ground water from leaching, runoff, and spray drift. When registered, a label is created to instruct the applicator on the proper usage of the material and required personal protective equipment. The EPA also must approve the language that appears on each pesticide label and the product can only be used legally according to the directions on the labeling accompanying it at the time of sale. The Forest Service is authorized by the FIFRA and the Cooperative Forestry Assistance Act to use pesticides for multiple-use resource management and maintenance of the quality of the environment as long as the actions comply with the National Environmental Policy Act and the Council on Environmental Quality regulations. Forest Service Manual 2150 (Pesticide Use Management and Coordination) and Forest Service Handbook 2109.14 (Pesticide Use Management and Coordination) provide direction on safe use of pesticides, including direction on storage and transport, and development of safety plans and emergency spill plans.

Forest Service Manual (FSM) 2900 (Invasive Species Management) directs the Forest Service to use an integrated weed management approach to control and contain the spread of noxious weeds on National Forest System (NFS) lands and from NFS lands to adjacent lands. Forest Service Handbook (FSH) 2109.14 Pesticide Use Management and Coordination provides additional direction related to implementation of invasive plant management, and FSM 2150 Pesticide Use Management and Coordination provides policy direction.

The *National Strategic Framework for Invasive Species Management* (USDA Forest Service 2013) provides broad strategic direction for Forest Service programs and incorporates the invasive Species Systems Approach which has four elements-prevention, detection, control and management, and restoration and rehabilitation.

The *National Strategy and Implementation Plan for Invasive Plant Species Management* (USDA Forest Service 2004),focuses on four key elements: preventing invasive species before they arrive; finding new infestations before they spread and become established; containing and reducing existing infestations; and rehabilitating and restoring native habitats and ecosystems.

The Forest Service Guide to Noxious Weed Prevention Practices (USDA Forest Service 2001) provides management guidance in the form of goals along with prevention practices. Forest

Service policy identifies prevention of the introduction and establishment of noxious weed infestations as an agency objective. This guide provides a comprehensive directory of weed prevention practices for use in Forest Service planning and wildland resource management activities and operation

At the regional level, the Intermountain Region of the Forest Service, headquartered in Ogden, Utah, issued an Invasive Species Management Strategy (2009) that outlines a regional plan for complying with national direction.

The intent of the Idaho Plant Pest Act of 2002 is to prevent the introduction and spread of plant pests in the State of Idaho by providing for regulation of plant material and plant pests. The Idaho Invasive Species Act of 2008 provides policy direction, planning, and authority to combat invasive species infestations throughout the state and to prevent the introduction of new species that may be harmful by implementing strategies that requires the State of Idaho to enhance its capacity to prioritize risks, prevent new invasions, employ early detection and rapid response techniques, apply state of the art control and management strategies, coordinate multiple public and private efforts and involve the public.

This FEIS complies with the Salmon and Challis National Forest Land and Resource Management Plans Final Environmental Impact Statements (1987 and 1988), and all associated amendments. Forest-wide desired condition, goals, objectives, and standards and guidelines for noxious weeds treatments are found under Range Resources in both the Challis and the Salmon Land and Resource Management Plans (LRMPs).

The desired condition for invasive plant management stated in the Challis LRMP:

- Noxious farm weed control in cooperation with the counties and other agencies will be increased over the current situation.
- The noxious weed program will be strengthened, with emphasis on controlling high priority weeds.

The Forest-wide goal and objective are:

- Maintain noxious weed control program at or above current level.
    - Update noxious weed infestation map and control plan annually in conformance with the integrated pest management policy. Continue modest investment in noxious weed and poisonous plant control. Emphasize education and information programs for persons who use herbicides or pesticides on the Challis National Forest.

The Challis LRMP identifies the following standards and guidelines:

- New infestations and areas where noxious farm weeds are spreading will receive first priority for treatment.
- Activities that create or provide for the establishment of noxious weeds will be required to provide for their control.
- Machine application of herbicide in the treatment of vegetation will not be permitted in riparian areas or where it might contaminate water courses or impact riparian vegetation.

Challis National Forest Plan Amendments (1992) have the following stand and guideline for Research Natural Areas (RNA):

- If exotic plants or animals have been, or are, introduced into the RNA, the Station Director and the Regional Forester shall exercise control measures that are in keeping

with established management principles and standards to eradicate them, when practical.

The desired condition for invasive plant management stated in the Salmon LRMP:

- Noxious weeds will be controlled to comply with State law and protect other resource values. Approximately 60 acres will be treated annually to eradicate new infestations and prevent the spread of existing infestations to adjacent Forest System lands and other adjacent ownerships.

The Forest-wide goal and objective are:

- Control noxious weeds as needed to protect the value of other resources and comply with State law.
    - Complete approximately 60 acres of noxious weed control treatments annually.

The Salmon NF LRMP identifies the following standards and guidelines:

- Treat noxious farm weeds in the following priority:
    - Leafy spurge and Russian and spotted knapweed, yellow star thistle, and musk thistle;
    - Invasion of new plant species classified as noxious farm weeds;
    - Infestation in new areas;
    - Expansion of existing infestations of Canada thistle and other noxious farm weeds;
    - Reduce acreage of current infestation.

The Salmon NF LRMP also identifies the following general direction:

- Limit use of herbicides, insecticides, rodenticides, or other chemical agents as part of management activities to times and places where possible transport to or by surface water has a low probability of occurrence.

PACFISH (1995) and INFISH (1995) each identify the following standards and guidelines:

- RA-3: Apply herbicides, pesticides, and other toxicants, and other chemicals in a manner that does not retard or prevent attainment of Riparian Management Objectives and avoids adverse effects on listed anadromous fish.
- RA-5: Apply herbicides, pesticides, and other toxicants, and other chemicals in a manner that does not retard or prevent attainment of Riparian Management Objectives and avoids adverse effects on inland native fish.

1.6. Decision Framework

The Responsible Official is the Salmon-Challis National Forest Supervisor, who will make the following decisions based on the interdisciplinary analysis:

- Whether to select the proposed invasive plant treatments with any modifications from public scoping or comments or as described in an alternative
- Which project design features are needed
- What monitoring is required

The Forest Supervisor will base the decision on how well the alternative meets the purpose and need for action, as indicated by:

- Whether the alternative includes treatment of newly discovered infestations
- Percentage of known treatment land base where effective treatments are available

- Treatment cost and efficiency
- The degree to which the alternative minimizes potential adverse impacts to human health and the environment, based on issue indicators shown below.

1.7. Public Involvement

The Notice of Intent (NOI) was published in the Federal Register on June 23, 2011. The NOI asked for public comment on the proposal until August 2011. As part of the public involvement process, the agency sent a detailed proposed action to an extensive mailing list via mail and email, and placed press releases in the Challis Messenger, Salmon Recorder Herald, and the Arco Advertiser on April 19, 2012 with a website and contact information.

SCNF personnel met with the Shoshone-Bannock tribe in Challis, Idaho on May 3, 2012 and at Fort Hall, Idaho on June 11, 2012 to discuss the proposed project. The project was published in the July 2011 Schedule of Proposed Actions.

The Notice of Availability (NOA) for the Draft EIS was published in the Federal Register on Februaruy 13, 2015. The public comment period extended to March 30, 2015. The NOA and links to the DEIS were sent to an extensive mailing list via mail and email. A legal notice was published in the newspaper of record, the Salmon Recorder Herald, and press releases were published in the Challis Messenger and the Arco Advertiser on February 19, 2015. Five comment letters were received.

1.8. Issues

Seven organizations and individuals provided comment letters during scoping, all of which are located in the project record. Comments were analyzed, and public issues were identified based on these scoping comments. Many important public issues are addressed through the design of the Proposed Action. An example is human health, an issue of great public concern. All alternatives avoid the type of herbicide use associated with harmful exposures to workers and/or the public. The issue of human health is discussed throughout this document because it is of such great importance to the public, but is not the basis for alternative comparison because all alternatives equally address this issue.

The Forest Service separated the issues into two groups: significant and non-significant issues. Significant issues were defined as those directly or indirectly caused by implementing the proposed action. Non-significant issues were identified as those: 1) outside the scope of the proposed action; 2) already decided by law, regulation, Forest Plan, or other higher level decision; 3) irrelevant to the decision to be made; or 4) conjectural and not supported by scientific or factual evidence. The Council on Environmental Quality (CEQ) NEPA regulations explain this delineation in Sec. 1501.7, "…identify and eliminate from detailed study the issues which are not significant or which have been covered by prior environmental review (Sec. 1506.3)…". These issues are identified in the issue analysis form which is located in the project record.

The Forest Service identified the following issues from public comments received during scoping as well as those identified internally:

1.8.1. Vegetation

Invasive plant treatments have the potential to impact both native plant communities and invasive plant infestations in the project area.

Measurement Indicators

- Treatment methods available for use
    - Biological Control
    - Herbicide
        - Terrestrial Application
            - Ground-based application
            - Aerial Application
        - Aquatic Application
    - Mechanical
- Number of Herbicides Available for Use
- Treatment Acres by Method
    - Numbers of biological control releases
    - Acres of terrestrial herbicide application
    - Acres of aerial herbicide application
    - Acres of mechanical control

1.8.2. Soil and Water

The use of herbicides in riparian areas has the potential to adversely impact water quality. Herbicides could pollute water and affect source water protection areas. There may be potential adverse effects of herbicide treatment on soils and potential for leaching into ground water.

Measurement Indicators

- Instream Sediment Loads: Estimated change in hillslope and stream bank sediment delivery to streams (based on qualitative evaluation).
- Herbicide Concentrations in Water: Estimated concentrations of herbicides in streams and other surface waters, groundwater, and drinking water source areas (based on modeling).
- Riparian Function: Estimated change in weed infested acres within Riparian Habitat Conservation Areas, as a measure of riparian and stream channel function.
- Soil Condition: Estimated change in soil condition (based on qualitative evaluation).

1.8.3. Fisheries

The use of herbicides in riparian areas has the potential to adversely impact water quality and aquatic species. Herbicides could contaminate water, harm fish through exposure to chemicals, and negatively affect aquatic plants and insects.

Measurement Indicators:

- Effects of herbicide to be used within riparian areas on aquatic organisms

- Adequacy of design criteria that apply to water quality and aquatic organisms

1.8.4. Wildlife

Herbicide exposure, resulting from herbicide toxicity, may cause harm to terrestrial wildlife species.

Measurement Indicators

- Toxicity potential of herbicides being used
- Routes of exposure
- Adequacy of design criteria to protect wildlife

1.8.5. Sensitive Plants

Herbicide exposure, resulting from herbicide drift, residue, or direct application, may cause harm to non-target plants.

Measurement Indicators

- Effects of weed treatment type on SCNF sensitive plant species
    - biological control
    - herbicide application
    - mechanical control

1.8.6. Human Health

The potential toxicity of herbicides and exposure to herbicides may have human health consequences.

Measurement Indicators

- Toxicity potential of herbicides being used
- Adequacy of design criteria to protect human health

1.8.7. Recreation

Invasive plant infestation and treatment methods could negatively affect recreationalists' experiences.

Measurement Indicators

- Effects to visual resources
- Effects to Wild and Scenic River (WSR) designated and eligible streams
- Effects to Idaho Roadless Areas

1.8.8. Economic Efficiency

Economic efficiency of treatment methods should be considered in the analysis.

Measurement Indicator

- Average cost of treatment method per acre

1.8.9. Other Environmental Considerations

In addition to the issues described above, there are other environmental considerations that were brought up during scoping or which must be disclosed by law. Effects analyses for these other considerations are presented in Chapter 3. These include cultural resources, climate change, tribal consultation, and rangeland resources.

Chapter 2. ALTERNATIVES, INCLUDING THE PROPOSED ACTION

2.1. Introduction

Chapter 2 describes and compares alternatives considered for invasive plant treatment on the non-wilderness portion of the three million-acre extent of the Salmon-Challis National Forest (SCNF).

Invasive plant infestations are the proposed treatment sites. Inventoried noxious weed infestations have been mapped and are displayed (Maps A1 through A5). Based on current inventories there are 22 State and one county-listed noxious weed species covering approximately 49,000 acres across the SCNF. The proposal is to treat up to 20,000 acres of invasive plants annually with an effective, integrated combination of treatments including biological, manual and mechanical, chemical (herbicide), and restoration methods (competitive seeding and planting). The project is anticipated to last 10 to 15 years or until conditions substantially change.

Untreated invasive plant infestations have the potential to expand at an average rate of 1.3 to 25 percent each year (Duncan and Clark 2005). Increases are due to growth of existing plants and spread by a variety of vectors, such as wind, water, animals, and humans. Not all inventoried invasive plant populations receive treatment annually due to budget and personnel constraints. Retreatment is often necessary to maintain the control level of initial treatment depending on the invasive plant species, size and density of an infestation, seed bank viability and site conditions. Thus, multiple treatments may be necessary over the next fifteen years to achieve control objectives on known sites.

This FEIS considers five alternatives in detail; No Action (Alternative 1), Current Action (Alternative 2), Proposed Action , which is also the preferred alternative (Alternative 3), No Aerial Herbicide Application (Alternative 4), and No Aquatic Herbicide Application (Alternative 5). The Forest Service developed the action alternatives in response to issues raised by the public and to meet legal requirements.

The Proposed Action includes treatment of invasive plant species and/or sites that are currently not present or are yet undiscovered. As described in Chapter 1, detecting and treating new infestations when they are small (referred to as Early Detection/Rapid Response or EDRR) increases effectiveness of the invasive plant program and minimizes adverse effects. The Proposed Action includes treatment of new detections using the same methods used on known sites.

2.2. Alternatives Considered in Detail

2.2.1. Alternative 1-No Action

This alternative is required by regulation (40 CFR 1502.14) and would call for no invasive plant management treatments applied to any non-wilderness National Forest System (NFS) lands, except for those NFS lands under road right-of-way (ROW) agreements with the different counties within the SCNF. In these situations, the authority to undertake treatments is vested in those agencies. The alternative provides a baseline for comparison and analysis of effects.

There would be no herbicide application (ground based or aerial application), mechanical methods (hand or tool grubbing, mowing), revegetation, or biological control. Existing biological controls would progress naturally, but no supplementation would occur. Ongoing invasive plant prevention and education would continue, but additional measures would not.

2.2.2 Alternative 2-Current Action

The Current Action alternative includes an array of standard invasive plant management practices: information and education programs, cooperative partnerships and coordination, inventory and early detection, control methods, restoration and revegetation, where appropriate, monitoring to track treatment effectiveness, and a broad range of Best Management Practices (BMPs) and design criteria.

National Forests are directed to implement an invasive species systems approach per nationally established program components. However, the current invasive plant management program does not contain a fully adaptive invasive species systems approach (USDA Forest Service 2013). The lack of a forest-wide strategy for invasive species affects the ability to capture funding, to identify risk for invasion and spread, to fully respond to EDRR needs, and to adequately address the size and density of larger infestations for which treatment is being deferred.

The SCNF invasive plant prevention plan is located in Appendix C, however, the practices in the plan are not part of the FEIS analysis.

Treatment Methods

The current invasive plant management program utilizes a variety of tools, used alone or in combination, to treat invasive plants on the SCNF. Treatment methods include the following:

- Biological control through the use of predators, parasites, and pathogens.
- Herbicide control using ground-based spot and broadcast application methods.
- Mechanical and manual methods, such as hand pulling, mowing, cutting or torching.
- Rehabilitation and restoration methods such as seeding sites to improve competition or prevent establishment of non-native invasive plant species.

Table 2-1: Average Acres Treated Annually by Treatment Method[1]

Treatment Method	Acres
Biological Control[2]	365 acres
Mechanical Control	40 acres[3]
Herbicide Control	5,977 acres

[1] Based on 2010- 2012 three-year average from Forest Activity Tracking System (FACTS) database
[2] See Appendix A for list of species
[3] This number displays in FACTS as very low because mechanical treatments are not consistently entered into the FACTS database

Herbicide formulations, active ingredients and application rates currently in use in the SCNF are displayed in Table 2-2. The range of application rates for each chemical is derived from Human Health and Ecological Risk Assessments and the herbicide label. The table displays typical application rates, but based on circumstances, herbicides may be applied at maximum application rates.

Combinations of herbicides may be the most appropriate treatment where several species of invasive plants occur together, or where the herbicides affect invasive plants differently. For example, a mixture of picloram and imazapic, which are both broadleaf-selective herbicides, is

commonly used to simultaneously treat invasive plants in the sunflower family (picloram) and in the mustard family (imazapic). Herbicide treatment is also used in conjunction with, or preceding, cultural or mechanical treatments, depending on invasive plant species composition, infestation level, and environmental setting.

Table 2-2: Herbicides and Application Settings Currently Used in the SCNF

Herbicide (Active Ingredient)	Maximum Label Application Rate (AI or AE/AC)	Typical SCNF Application Rate (lbs. AI[1] or AE[2]/AC)[3]	Application Setting			
			Upland	Riparian	Aerial	Aquatic
2,4-D amine	2.0 lbs ae /ac/app[4] 2 apps per year	0.5-2.0 lb./ac	X	X		
chlorsulfuron	2.6 oz. product/ac/year (0.12 lbs ai/ac/year)	0.5 - 2.0 oz./ac (0.02 - 0.09 lb./ac)	X	X		
clopyralid	0.5 lbs ae/ac/year	0.28 - 0.5 lb./ac	X	X		
dicamba	1.0 lbs ae/ac/app 2 apps per year	0.75 - 2.0 lb./ac	X			
glyphosate	1.7 lbs ae/ac/app ≤ 8.0 lbs ae/ac/year	0.35 -5.0 lb./ac	X	X		
imazapic	0.19 lbs ai/ac/year	0.1 - 0.19 lb./ac	X	X		
metsulfuron-methyl	4.0 oz. product/ac/year (0.15 lbs ai/ac/year)	1.0 - 3.0 oz./ac (0.04 - 0.11 lb./ac)	X	X		
picloram	1.0 lbs ai/ac/year	0.5 - 0.75 lb./ac	X			
sulfometuron methyl	8.0 oz. product/ac/year (0.37 lbs ai/ac/year)	2.0 - 6.0 oz./ac (0.09 - 0.28 lb./ac)	X	X		
triclopyr: triethylamine salt (TEA)	9.0 lbs ae/ac/year	4.5 - 6.0 lb./ac	X	X		

[1]AI= Active Ingredient [2]AE=Acid Equivalent [3]AC=Acre [4]app=application

Section 7 of the Endangered Species Act consultation regarding the current invasive plant treatment was completed with the regulatory agencies (NMFS and USFWS) in June 2012. The Biological Opinion received from the NMFS specified that no more than 5,500 acres would have herbicide applied annually and no more than 550 acres of those acres would be chemically treated within 100 feet of live water. The last three-year average has been 1,077 acres of applied herbicide, with 389 of those acres being less than 100 feet from water (Table 2-3).

Table 2-3: 2010-2012 Average Annual Applied Herbicide Output in Uplands and Riparian Areas by Invasive Plant Management Zone

Invasive Plant Management Zone	Applied Acreage in Uplands	Applied Acreage in Riparian Areas[1]	Total Applied Acreage
Lemhi Zone	64.4	29.1	**93.5**
North Zone	347.1	69.1	**416.2**
Pahsimeroi-Lost Zone	35.1	181.3	**216.4**

Invasive Plant Management Zone	Applied Acreage in Uplands	Applied Acreage in Riparian Areas[1]	Total Applied Acreage
Salmon Zone	220.4	97.3	**317.7**
Upper Salmon Zone	21.1	11.8	**32.9**
Entire Project Area	**688.0**	**388.6**	**1076.7**

[1]For the purposes of this analysis, riparian acreage refers to applications made within 100 feet of live water, whether running water (e.g. streams) or still water (e.g. ponds).

Under the Current Action, the SCNF has a prescribed set of buffers, which take herbicide application method, distance to open water, and wind speed into consideration. Table 2-4 displays these buffer distances from water and Table 2-5 displays approved maximum wind speeds and application methods. No adjuvants are currently used within 15 feet of open water in the SCNF.

Table 2-4: Herbicide Use in the SCNF based on Proximity to Water

Active Ingredient	Distance to Open Water in Feet		
	< 15 feet	15-50 feet	> 50 feet
2, 4-D	X	X	X
chlorsulfuron		X	X
clopyralid		X	X
dicamba			X
glyphosate	X	X	X
imazapic		X	X
metsulfuron methyl		X	X
picloram			X
sulfometuron methyl		X	X
triclopyr TEA		X	X

Table 2-5: Maximum Wind Speeds and Associated Applications

Buffer from Open Water (feet)	Maximum Wind Speed (mph)	Application Method
> 100	10	All ground application techniques and broadcast application
50 - 100	10 (Picloram – 5)	Spot Spraying, Wicking, Dipping, Painting and Injecting
< 50	5	Spot Spraying, Wicking, Dipping, Painting and Injecting
< 15	5	Spot Spraying, Wicking, Dipping, Painting and Injecting

Table 2-6: Three Year Average Applied Herbicide Acres by Invasive Plant Management Zone (2010-2012)

Herbicide	Lemhi Zone	North Zone	Pahsimeroi -Lost River Zone	Salmon Zone	Upper Salmon Zone	Project Area
2, 4 D	0.6	16.9	101.2	8.4	2.4	**129.5**
aminopyralid[1]	0.0	0.0	0.0	0.0	2.6	**2.6**
chlorsulfuron	10.3	43.9	6.6	40.9	0.4	**102.0**
clopyralid	21.5	157.2	3.7	96.5	5.0	**283.9**
dicamba	0.0	1.9	1.2	0.6	3.0	**6.7**

Herbicide	Lemhi Zone	North Zone	Pahsimeroi -Lost River Zone	Salmon Zone	Upper Salmon Zone	Project Area
glyphosate	0.0	0.3	0.0	0.1	2.4	**2.8**
imazapic	0.2	111.3	0.0	25.5	0.1	**137.0**
metsulfuron-methyl	0.0	0.0	1.2	0.0	0.1	**1.3**
picloram	60.9	84.7	102.5	145.8	17.0	**411.0**
Total Average Applied Acres	**93.5**	**416.2**	**216.4**	**317.7**	**33.0**	**1076.7**

[1] Accidental application, reported to NMFS and NFWS

Treated Acreage and Applied Acreage

For the purposes of this analysis, there is a difference of definition between treated and applied acres. Treated acres represent the area occupied by an invasive plant infestation - independent of plant density- that receives some sort of control treatment (generally herbicide in the context of this analysis). Applied acres represent the actual land area that received herbicide treatment. When spot treatment methods are utilized, the applied acres may be significantly less than the treated acres. When broadcast treatment methods are utilized, the treated acres and applied acres are similar.

It is not possible or even necessary for all infested acres to be treated annually. The use of herbicides with soil residual capability means that more than one season or year of control can be obtained by a single herbicide application. Intermountain Region direction (USDA Forest Service R4 2009) states the control objective for widely distributed invasive plant species that cannot be eradicated is to maintain invasive plant density at levels that do not interfere with the structure and function of desired plant communities and the delivery of ecosystem services. This aligns with research that shows that suppression of invasive plants with occasional herbicide applications can still provide for functioning plant communities while reducing herbicide impacts to non-target forb species (Crone et al. 2009)

Design Criteria

Biological Control

- Obtain Animal and Plant Health Inspection Service (APHIS) permit to Move Live Plant Pests, Noxious Weeds, or Soil for those agents when transportation across state lines is involved.
- There would be no intentional releases of unapproved biological control agents.
- There would be no intentional releases of agents known to feed on species other than those that were introduced to control specified invasive plant species.
- Use appropriate Forest Service protocols for documentation of releases and monitoring and share release information with the Idaho State Department of Agriculture.
- Where possible, collect biological control agents locally or from areas with similar climatic and weather conditions, land and soil types, and cover types to maximize successful establishment to the extent practicable.
- Distribute biological control agents at the optimal season and life cycle stage to optimize the likelihood of successful establishment. Distribute quantities sufficient to optimize successful short-term establishment.

- For those agents that self-disperse poorly, actively assist the distribution throughout target infestations by redistribution (collecting and moving the agent to new locations).

General Herbicide Application

- Herbicide application shall comply with applicable laws (Idaho Statute Title 22, Chapter 34 and Idaho Administrative Code Rule 02.03.03), Forest Service policy and guidelines (FSH 2109 and FSM 2150) and with product label directions for the herbicide being used to assure worker safety and to manage potential impacts of herbicide application.
- Always read and follow label directions, including instructions for herbicide use, application rates, equipment and techniques and personal protective equipment for applicators.
- See Table 2-4 regarding application of herbicides in proximity to water.
- Prior to implementation, program managers would ensure proper permitting is in place including National Pollutant Discharge Elimination System (NPDES) permits.
- Make sure Material Safety and Data Sheets, safety plans, spill prevention plans and cleanup kits are available to applicators, per the requirements of FSH 2109.
- Keep accurate and detailed application records, per Idaho Department of Agriculture Rules Governing Pesticide and Chemigation Use and Application (Idaho Statute Title 22, Chapter 34 and Idaho Administrative Code Rule 02.03.03).
- Perform herbicide applications by or under the direct supervision of licensed Idaho professional herbicide applicators for forest and contract crews, per Idaho Department of Agriculture Rules Governing Pesticide Use and Application.
- Ensure that contracts and agreements include appropriate prescriptions and that herbicides and application rates meet label requirements and site specific design criteria.
- Monitor wind speed and direction and equipment and spray parameters throughout an herbicide application. No herbicide shall be applied in sustained wind conditions exceeding five (5) miles per hour in riparian areas or in any wind conditions exceeding product label directions.
- Conduct equipment and personnel inspections and calibration as needed to ensure proper herbicide application and to meet regulatory requirements. Regularly check equipment and components for wear. Attend to repairs and parts replacement promptly.
- Transport only the quantity of herbicide and adjuvants needed for a project. Secure containers being transported in such a way to prevent the likelihood of spills. Make periodic checks en route to help avoid spillage. Carry herbicides and adjuvants in water-tight, floatable containers when supplies need to be carried over water by boat, raft, or other watercraft.
- When out in the field, restrict access to herbicides and adjuvants and spray equipment by unauthorized personnel to the extent possible.
- OHVs used to transport or spray herbicides are administratively allowed to travel off designated motorized routes. These vehicles would not be taken off designated routes if damage to soils could occur due to wet conditions. Take care to ensure that disturbance to desirable vegetation is minimized and that no visible “trail” creation occurs.
- Follow the procedures in the SCNF Spill Plan in the event of a spill (Appendix B).
- Use indicator dye in the herbicide mix to visually assure uniform coverage, minimize overlapped or skipped areas, and prevent non-target applications. Indicator dyes will be water-soluble and non-toxic.
- Within areas of special concern, such as developed recreation sites, trailheads, campsites and other high human areas, utilize treatments methods that minimize potential exposure to the public.

- To minimize herbicide drift during broadcast operations, use low pressure and larger droplet size to the extent possible with the equipment being used. Use nozzles designed for herbicide application.
- Equip water drafting equipment with back siphoning prevention devices.
- Wherever possible, mix and load at a distance greater than 100 feet from water and where spilled materials will not flow into groundwater, wetlands, or streams.
- Provide herbicide "awareness" information to forest users as opportunities arise. Treatment areas will be signed prior to herbicide applications within areas of special concern, such as trailheads, campsites, and other high use areas. Make information on where and when spraying and other treatments would occur available to the public at the local Ranger District office. Forest Service and other websites may also be used for public notification.
- Follow label directions and other information sources to apply herbicides to the target species during phenological stages that optimize target control.
- To the extent practicable, apply herbicides to infestations containing biological control agents at times when the effects of herbicides to the host plants would not interfere with the agent's life cycle.
- Avoid non-target damage to the extent practicable. Native or desired plant species may compete well with the target invasive plant species once its density has been reduced and help in recovery of the site through natural means.

Sensitive Plant Species

- Provide training on SCNF sensitive plant identification and key habitat characteristics to help field crews correctly identify, survey, and map Sensitive plants and successfully implement invasive plant control treatments in sensitive plant populations.
- Evaluate sites considered for herbicide treatment for sensitive plant habitat suitability. Survey suitable habitat as necessary prior to treatment. The need for field surveys in suitable habitat is based on factors such as plant phenology at the time of treatment and species' susceptibility to the herbicide(s) being used.
- Mechanical treatment, individual plant treatment, or spot herbicide applications are preferred methods when treating invasive plant infestations within or directly adjacent to sensitive plant populations.
- To minimize herbicide drift, suspend herbicide applications in or directly adjacent to sensitive plant populations when sustained wind speeds exceed 5 miles per hour. Conduct post-treatment monitoring in known sensitive plant populations to determine efficacy of the invasive plant control treatment and to detect unacceptable non-target impacts. This provides feedback that helps improve future herbicide control efforts.

Manual and Mechanical Treatment

- Obtain necessary state and federal permits, when and where required.
- Consult an archaeologist prior to initiation of work when the mechanical method to be used has the potential to affect cultural resource sites.
- Minimize soil disturbance as much as possible to prevent deeply buried invasive plant seeds being brought to the soil surface, promoting a sprouting event that could increase the density of the invasive plant species or create areas of bare soil that would provide an optimal seed bed in which new invasive species can sprout.
- Avoid non-target species damage to the extent practicable. Select mechanical methods to effectively control the target species (e.g. grubbing/hoeing is inappropriate for rhizomatous

species and may increase the density of the invasive plant as root fragments sprout and become new plants).

- Apply mechanical treatments at the proper stage of plant growth when treatment will be most effective at controlling the target invasive plant.
- Thoroughly inspect and clean all equipment and clothing to remove invasive plant seeds or vegetative propagules to prevent the movement of the invasive plant to another site.
- To the extent practicable, conduct clipping and removal of seed stalks when seeds are at or nearing maturity to reduce inputs to the seed bank or when seeds are easily picked up and transported by vectors such as wind, humans or animals (e.g. wind-dispersed seeds such as rush skeletonweed or bur-like seeds such as houndstongue that cling to fur and clothing).
- Prior to burning to manage invasive plants, a prescribed burn plan will be completed and compliant with the Interagency Prescribed Fire Planning and Implementation Procedures Guide.
- Specific to aquatic invasive species, hand-pulling may be used when an infestation is very limited in extent and occurs close to the shoreline of a water body, but has not yet infested deeper waters.

Rehabilitation and Restoration

- Natural revegetation is the preferred option whenever possible. Assess invasive plant-infested sites to determine if the area is capable of natural recovery after control treatments. Determine what mix of desirable or native grass and forb plants still occur on the site and if they are numerous and vigorous enough to be capable of spreading vegetatively or via seed production.
- Assess erosion processes that may be affecting the site and the degree of severity of any soil erosion.
- Consider the most effective, practical and suitable means of providing rehabilitative or restorative measures, whether eliminating sources of disturbance other than invasive plants, or actions such as seeding and/or mulching.
- Consider the need to control invasive annual grasses, such as cheatgrass, and forbs, such as annual mustards, that are known to compete aggressively with perennial seedlings trying to establish.
- Determine whether additional assistive measures may be required, such as cover crops, hydraulic mulches, and mycorrhizal inoculums.
- Use native plants in rehabilitation and restoration where practicable.
- If it is determined that non-native species are the best choice for interim or permanent revegetation, be sure to select species that do not behave invasively under conditions similar to those at the site to be revegetated.
- Purchase only certified invasive plant-seed-free seed. Consider the use of site-adapted seed, if available and practicable.
- When seeding, determine the need for site preparation and protective measures that may need to be taken to allow the seeding to establish successfully.
- Plan revegetation activities at the optimal season and site conditions for successful establishment.
- Design seed mixes, whether native or desirable species, that are adapted to site conditions (including soil type, precipitation patterns, plant hardiness zones, etc.)
- Following establishment, continue to practice proper vegetation management to maintain a healthy, functioning plant community that is resilient to disturbance and resistant to invasive plant re-invasion.

- Use only invasive plant seed-free mulches and other products for uses such as erosion control and improved seed germination.
- Ensure that treatment tools and other equipment are free of invasive plant seeds before moving to or using on the project site.
- Minimize ground-disturbing activities to the extent possible during reseeding efforts.
- Consult an archaeologist prior to initiation of work when the method to be used has the potential to affect cultural resource sites.

2.2.3. Alternative 3-Proposed Action

The proposed action is to prevent the establishment of new invasive plant species, prevent further spread of existing invasive plant species, and maintain native plant communities. The proposed action would implement an adaptive integrated weed management (IWM) strategy to eradicate or control existing or newly discovered invasive plants over the next ten to fifteen years as budgets allow. The IWM strategy is derived from the Forest Service National Strategic Framework for Invasive Species Management (2013), Forest Service National Strategy and Implementation Plan for Invasive Species Management (2004), Strategy for Noxious and Nonnative Invasive Plant Management (USDA Forest Service 1998a), and the Forest Service Invasive Species Management Manual (FSM 2900), all of which direct National Forests to implement adaptive integrated weed management programs with the following nationally established program components.

Prevention

Prevention is the “first line of defense” and is a crucial element of IWM. The goal is to prevent the introduction and establishment of new invasive plant species. External and internal education and outreach is essential. A variety of educational materials such as signage, exhibits, presentations, and workshops would be used by the Forest and cooperative partners to raise public awareness of invasive plants and the ecological and economic damage created by their establishment and spread. Internal training would be used to educate personnel to recognize invasive plant species, understand vectors and preventive measures, incorporate preventive measures into the project design of all projects and activities, follow procedures for reporting and mapping invasive plant infestations, and communicate with other programs and agencies. This is a non-treatment aspect of the IWM approach. The SCNF invasive plant prevention plan is located in Appendix C; however, the practices in the plan are not part of the FEIS analysis.

Early Detection/Rapid Response

Early Detection and Rapid Response (EDRR) is a critical component of an IWM program. As new invasive plant infestations are detected, a quick and coordinated inventory and eradication response would reduce negative environmental and economic impacts.

EDRR is intended to find new invasive plant infestations at the earliest stages of invasion resulting in decreased control costs and the need for repeated treatments. New invasive species may not be listed as a noxious on the statewide list; however, these plants are identified on statewide watch or EDRR lists.

The Proposed Action includes new national direction on the control of new detections. Invasive plant sites that are discovered subsequent to the current invasive plant inventory would be

evaluated to determine that the eradication treatments and environmental impacts are consistent with those analyzed in this FEIS.

Control and Management

The integrated and adaptive invasive plant management strategy proposed would facilitate the use of a variety of treatment options and combinations intended to minimize the effect of invasive plants and limit their spread.

Control techniques include manual/mechanical, chemical, and biological methods. Areas infested by invasive plants on the SCNF may exhibit a wide range of site conditions. Effective control relies on a clear understanding of the target species: its biology, the ecosystem it has infested, associated introduction pathways, and effective control methods. Control often requires repeat treatments and monitoring of control efficacy.

A variety of treatment options and combinations that could be applied to a wide range of site conditions are necessary so that flexibility is provided to increase effectiveness, reduce cost, and minimize potential for adverse effects from treatments. As monitoring identifies the effectiveness of treatments, specific control measures are adjusted.

The proposed action identifies the treatment of up to 20,000 acres of invasive plants annually. This number exceeds the current budget allocated for treatments, but is intended to be robust enough to address both known and future invasive plant infestations. The control and management aspect of the IWM strategy is the focus of the analysis in this FEIS.

Rehabilitation and Restoration

Ultimately, the goal for invasive plant management efforts is to restore and maintain healthy native or desired plant communities that are resistant to invasive plant establishment, which recover quickly from disturbances, and provide ecosystem functionality. Many invasive plant-infested plant communities are able to successfully re-establish without intervention after control efforts. However, sites that are severely damaged or at which few desirable species remain may not be able to recover without help.

Rehabilitation and restoration are vital components of an adaptive IWM program. Rehabilitation is defined as short-term mitigation to ensure minimum site stability and functionality. This may include site preparation and seeding of desirable vegetation. Restoration is a long-term objective and involves returning sites to natural functions and native species.

Monitoring

Monitoring is a necessary part of implementing an adaptive IWM program. Monitoring provides the data for adaptive management. Information collected from monitoring may be used by managers to evaluate the efficacy of prevention, EDRR, treatment, and rehabilitation and restoration actions. There are two basic types of monitoring essential to an adaptive integrated weed management plan: implementation monitoring and effectiveness monitoring. Implementation monitoring answers the question, “Did we do what we said we would do?” and effectiveness monitoring answers the questions, “Were prevention, treatment and restoration actions effective?” and “Were intended goals accomplished?”.

Managers may use monitoring data from one site or set of sites to predict the effects of similar actions on other parts of the project area. This information can be used to promote the use of the most effective techniques for prevention, detection, treatment, and restoration, and avoid the use of ineffective methods.

Treatment Methods

The proposed adaptive IWM program would utilize a variety of tools, used alone or in combination, to treat invasive plants on the SCNF. Proposed treatment methods include the following:

- Biological control through the use of predators, parasites, and pathogens.
- Herbicide control using ground-based application methods.
- Herbicide control using helicopter aerial application methods.
- Herbicide control using aquatic application methods.
- Manual and mechanical methods, such as hand pulling, mowing, cutting, or torching.
- Rehabilitation and restoration methods such as seeding sites to improve competition or prevent establishment of non-native invasive plant species.

Table 2-7: Maximum Acres to be Treated Annually by Treatment Method

Treatment Method	Maximum Acres Treated[1]
Biological Control	2,000
Mechanical Control	2,000
Herbicide Control	16,000
• Ground Application	8,000
• Aerial Application	8,000
• Aquatic Application	Unknown as there are no infestations at present

[1]See Table 2-11 for complete description

The treatments would abide by design criteria , the purpose of which is to reduce or eliminate the potential adverse impacts of the various invasive plant treatments. Design criteria are a set of required implementation features applied to projects to ensure that the project is conducted according to environmental standards and that adverse effects are within the scope of those predicted in this FEIS. Implementation of the design criteria is mandatory. The effectiveness of the design criteria is addressed throughout Chapter 3.

Treatment Priority and Strategy

Treatment priorities are based on factors such as the current abundance and distribution of the species, type and values of the site affected, and risk for spread or infestation into other areas. Other program management considerations may affect priorities. For example, priority may be given to sites located in areas proposed for ground-disturbing management activities. In addition, opportunities for special funding or cooperative projects with other landowners, agencies, and organizations may be considered. Treatment priorities do not necessarily refer to the order in which an infestation is treated during a given fiscal year. They are part of an adaptive integrated weed management strategy used by managers in determining how to allocate resources.

The SCNF criteria for determining treatment priority of invasive plant infestations are in Table 2-8. Higher priority is generally given to those new invasive plant infestations where reduction or eradication of infestations is likely to be successful. For established infestations, suppression strategies play a much more important role. In general, the vast majority of currently inventoried infested acres are associated with human-caused disturbance such as travel routes. Because they

are common to infestations at all potential priority levels, spread vectors such as trailheads, roadways, campgrounds, and parking areas are not explicitly considered when setting priorities.

Table 2-8: Treatment Priorities

Priority	Description	Treatment Objective
Highest	• Infestations of species new to the project area (EDRR).	Eradication of new species
Second priority	• Infestations of species that occur rarely within the project area. • Infestations of species that occur rarely within a given zone. • Infestations that pose substantial risk of infestation to priority areas currently free of the invasive species	Control by suppression to reduce existing infestations and reduce or eliminate new infestations of uncommon noxious weeds.
Third priority	• Infestations in or near areas that experience disturbance due to human activity, such as designated travel routes, recreation sites, emergency staging areas, and gravel pits. • Infestations in or near areas that experience disturbance due to natural forces, such as those recently affected by wildfire. • Infestations with the potential to spread across ownership boundaries onto lands that are not currently infested. • Infestations for which treatment has a high probability of success.	Control by direct suppression. Utilize indirect suppression where practical for achieving control.
Fourth priority	• Infestations in or near areas that contain desirable plant communities, such as intact native plant communities and sensitive, threatened, or endangered plant or animal habitat. • Infestations of established species occurring in an otherwise uninfested area.	Control by direct suppression
Fifth priority	• Infestations in habitat susceptible to invasion by and spread of invasive plants. • Infestations of established invasive plants in generally infested areas. • Large infestations of established invasive plants.	Control by direct suppression when possible. Emphasis placed on indirect suppression.

Table 2-9 summarizes commonly used species-specific integrated control measures that would be applied to known noxious weed species in the SCNF. The table displays a range of effective treatment options. Different treatment choices may be used based on circumstances such as new Endangered Species Act (ESA) consultation requirements, information on treatment effectiveness, and availability of new products. The priority and intensity of treatment needed varies widely based on site conditions, resources at risk from invasion, and the range and aggressiveness of individual target species.

Table 2-9: Range of Effective Treatment Options by Target Species

Noxious Weed	Treatment Method[1]		
	Biological	Chemical	Mechanical
Russian Knapweed	*Subanguina picridis, Jaapiella ivannikovi*	triclopyr + clopyralid; picloram; clopyralid + 2,4-D; clopyralid; aminopyralid; aminopyralid + metsulfuron; aminopyralid + 2,4-D; glyphosate; 2,4-D; chlorsulfuron	Pulling and Hoeing
Hoary Alyssum	None Currently Available	metsulfuron; chlorsulfuron	Pulling
Whitetop	None Currently Available	metsulfuron; chlorsulfuron; metsulfuron + chlorsulfuron; 2,4-D	Not Effective
Musk Thistle	*Rhinocyllus conicus, Trichosirocalus horridus*	chlorsulfuron; metsulfuron; Part A[2]: metsulfuron, Part B: dicamba + 2,4-D; metsulfuron + chlorsulfuron; triclopyr + clopyralid; clopyralid; aminopyralid; aminopyralid + metsulfuron; aminopyralid + 2,4-D; picloram; clopyralid + 2,4-D; dicamba; 2,4-D; glyphosate + 2,4-D	Mowing/ Hoeing
Diffuse Knapweed	*Cyphocleonus achates, Larinus minutus, Sphenopter a jugoslavica, Urophora affinis, Urophora quadrifasciata, Bang asternus fausti, Pterolonche inspersa*	clopyralid + triclopyr; picloram; clopyralid; aminopyralid; aminopyralid + metsulfuron; aminopyralid + 2,4-D; clopyralid + 2,4-D; glyphosate; 2,4-D	Pulling and Hoeing
Spotted Knapweed	*Agapeta zoegana, Bangasternus fausti, Chaetorellia acrolophi, Cyphocleonus achates, Larinus minutus, Larinus obtusus, Metzneria paucipunctella, Sphenoptera jugoslavica, Terellia virens, Urophora affinis, Urophora quadrifasciata*	triclopyr + clopyralid; picloram; clopyralid + 2,4-D; clopyralid; aminopyralid; aminopyralid + 2,4-D; 2,4-D; glyphosate	Pulling and Hoeing
Rush Skeletonweed	*Cystiphora schmidti, Eriophyes chondrillae, Puccinia chondrillina, Bradyrrhoa gilveolella*	clopyralid; aminopyralid; aminopyralid + metsulfuron; picloram; metsulfuron + chlorsulfuron; 2,4-D	Mowing

Noxious Weed	Treatment Method[1]		
Oxeye Daisy	None Currently Available	metsulfuron; aminopyralid; aminopy ralid + metsulfuron; aminopyralid + 2,4-D; picloram; clopyralid	Pulling and Hoeing
Canada Thistle	*Rhinocyllus conicus, Urophora cardui, Hadroplontus litura*	clopyralid + triclopyr; clopyralid; aminopyralid; aminopyralid + metsulfuron; aminopyralid + 2,4-D; picloram; metsulfuron + chlorsulfuron; Part A: metsulfuron, Part B: dicamba + 2,4-D; chlorsulfuron; glyphosate; dicamba	Not Effective
Field Bindweed	*Aceria malherbae, Tyta luctuosa*	dicamba; picloram; dicamba + 2,4-D; Part A: metsulfuron, Part B: dicamba + 2,4-D; metsulfuron; metsulfuron + chlorsulfuron; glyphosate; 2,4-D	Not Effective
Houndstongue	None Currently Available	metsulfuron; aminopyralid + metsulfuron; imazapic; Part A: metsulfuron, Part B: dicamba + 2,4-D; picloram	Pulling and Hoeing
Leafy Spurge	*Aphthona cyparissiae, Aphthona czwalinae, Aphthona flava, Aphthona lacertosa, Aphthona nigriscutis, Hyles euphorbiae, Oberea erythrocephala*	imazapic; picloram + 2,4-D; picloram; glyphosate; dicamba	Mowing
Black Henbane	None Currently Available	metsulfuron; picloram; dicamba; metsulfuron + chlorsulfuron; Part A: metsulfuron, Part B: dicamba + 2,4-D	Pulling, Hoeing and Mowing
Common St. John's Wort	*Agrilus hyperici, Aplocera plagiata, Chrysolina hyperici, Chrysolina quadrigemina*	2,4-D; metsulfuron; glyphosate; imazapic; picloram	
Dyer's Woad	None Currently Available	metsulfuron; chlorsulfuron; Part A: metsulfuron,; Part B: dicamba + 2,4-D; metsulfuron + chlorsulfuron	Pulling
Perennial Pepperweed	None Currently Available	chlorsulfuron; metsulfuron; aminopyralid + metsulfuron; metsulfuron + chlorsulfuron; glyphosate; 2,4-D; imazapyr; Part A: metsulfuron, Part B: dicamba + 2,4-D; metsulfuron + chlorsulfuron	Mowing
Dalmatian Toadflax	*Brachypterolus pulicarius, , Mecinus janthinus, & Calophasia lunula*	chlorsulfuron; metsulfuron; picloram + chlorsulfuron; picloram; dicamba	Pulling

Noxious Weed	Treatment Method[1]		
Yellow Toadflax	*Brachypterolus pulicarius, Calophasia lunula,Gymnetron antirrhini, Mecinus janthinus*	chlorsulfuron; picloram + chlorsulfuron; picloram + metsulfuron; picloram; dicamba	Pulling
Scotch Thistle	None Currently Available	chlorsulfuron, metsulfuron, clopyralid + 2,4-D, clopyralid, aminopyralid, picloram, dicamba, 2,4-D	Hoeing
Knotweed	None Currently Available	imazapyr, glyphosate	Cut Stem
Sulphur Cinquefoil	None Currently Available	triclopyr, 2,4-D, picloram, chlorsulfuron, aminopyralid, metsulfuron	Hoeing
Saltcedar	*Diorhabda carinulata*	imazapyr, glyphosate, triclopyr	Cut Stump
Puncturevine	*Microlarinus lareynii*	chlorsulfuron, 2,4-D	Pulling, Hoeing, and Torching

[1] Prather et al. 2011, Prather 2012, Prather 2013, Newton et al. 2013
[2]Part A and Part B refer to tank mixes.

Early Detection/Rapid Response

Early detection and rapid response (EDRR) allows for discovery and treatment of invasive plant infestations located outside of currently identified infested areas. Infestations outside of currently identified areas may include new sites of noxious weeds currently known to exist in the forest, invasive plant species previously unknown on the Forest, or sites that currently exist, but have not been identified in Forest inventories to date. The intent of EDRR is to allow timely control, so that new infestations can be identified and treated when they are small, preventing establishment and spread, while reducing the costs, potential side effects of treatment, and impacts from the invasive plant. EDRR is based on the premise that the impacts of similar treatment methods are predictable, even though the exact location or timing of the treatment may be unpredictable. The incorporation of EDRR is common to all action alternatives.

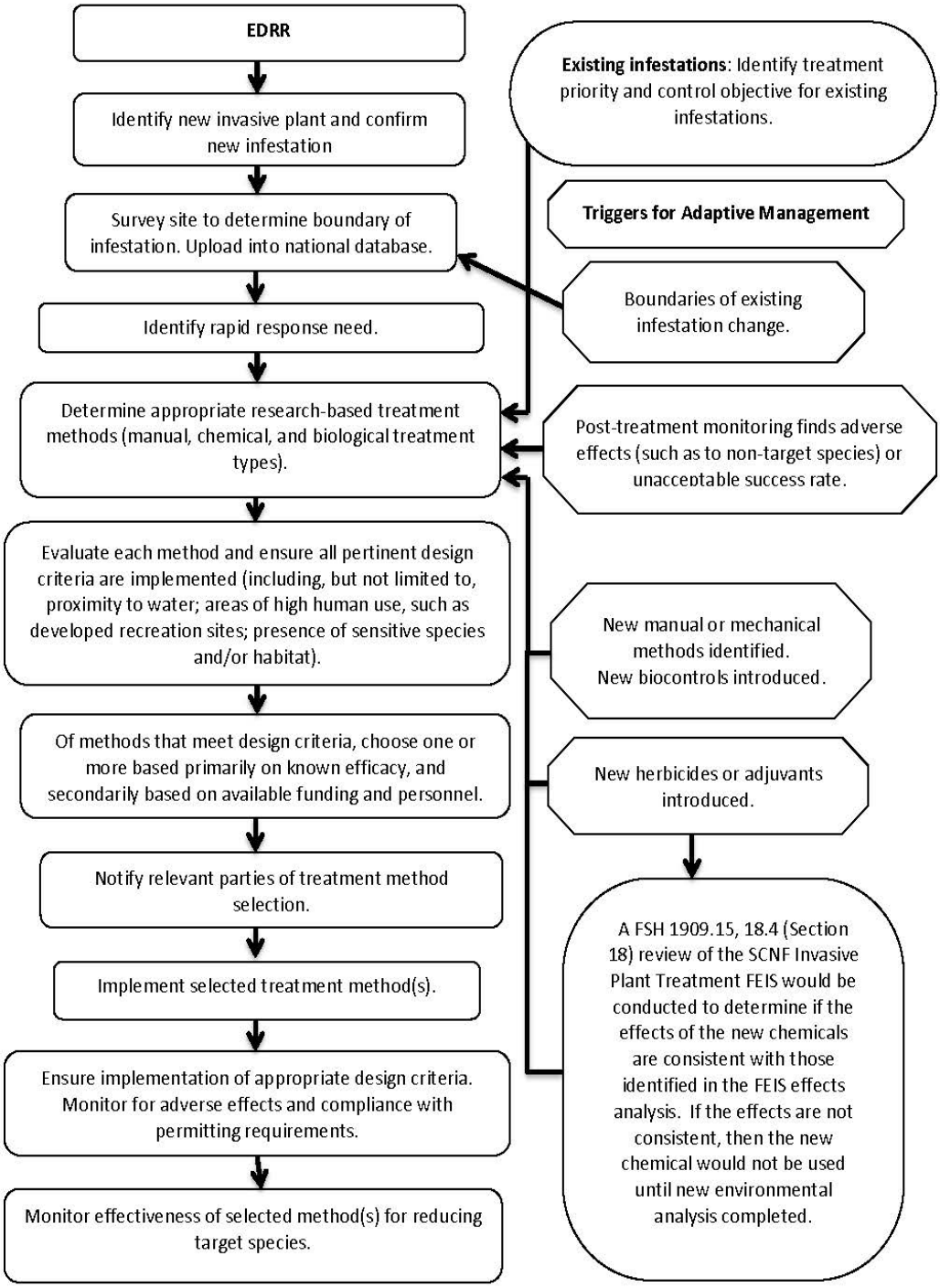
Adaptive Management

The proposed action, which incorporates EDRR, contains an adaptive management strategy to deal with invasive plant infestations that are constantly changing. An adaptive management strategy offers the means to describe and evaluate the consequences of changing or new invasive plant infestations and new treatment options. Provided that the results of treating new infestations and the impacts of new treatment methods remain within the effects described, then the results of this analysis remain valid. The adaptive management strategy consists of three principle components. Two are described below, and the third, monitoring, is discussed later in this section.

1. In order to quickly and effectively treat newly discovered invasive plant infestations while still addressing other resource concerns, a flowchart based on infestation size, location, site characteristics, and consultation with specialists would be used to select treatment methods (Figure 2-1). Priorities would be evaluated and established based on the criteria discussed in Table 2-8. All new sites would be mapped and inventoried. Appropriate design criteria must be applied to any invasive plant treatment.

2. New technology, biological controls, herbicide formulations, supplemental labels, and adjuvants are likely to be developed within the lifetime of this project. These new treatments would be considered when their use would be consistent with or less than the effects of those analyzed in this process. The Adaptive Management Strategy would allow incorporation of these new treatment methods if they meet the following criteria:
    - The herbicide must have an Environmental Protection Agency (EPA) approved herbicide label.
    - A risk assessment must be completed for the herbicide by the Natural Resources Conservation Service (NRCS), USDA Agriculture Research Station (ARS), Environmental Protection Agency (EPA), USDA Forest Service, Bureau of Land Management (BLM) or other federal land management agency.
    - New biological agents must be approved by USDA Animal, Plant Health Inspection Service (APHIS) and the State of Idaho prior to their introduction. This approval indicates that the agent is determined to be detrimental to the target plants while at the same time being virtually harmless to native or desirable non-native plants.
    - A FSH 1909.15, 18.4 (Section 18) review of the SCNF Invasive Plant Treatment FEIS would be conducted to determine if the effects of the new herbicide are consistent with those identified in the FEIS effects analysis. If the effects are not consistent, then the herbicide would not be used until a new environmental analysis was completed.
    - Endangered Species Act (ESA) section 7 consultation would be completed prior to the use of new herbicides.

Figure 2-1: EDRR and Adaptive Management Decision Tree



Control and Management

Biological Control

Biological control is the use of plant predators or pathogens that attack and weaken targeted invasive plant species and reduce their ability to compete or reproduce in order to reduce or eliminate invasive plant infestations. Biological controls would be used when the target species occupies extensive portions of the landscape, other methods of control are prohibitive based on cost and location, and an effective biological control regime exists. Biological control activities typically include the release of parasitic and “host specific'' insects, mites, nematodes, and pathogens. Biological treatments do not eradicate the target species, but rather reduce target plant densities to the point where competition with desired plant species for space, water, and nutrients keep populations in check. Biological control treatments are not consistent with an eradication objective, but are an integral part of an integrated weed management approach.

Animal and Plant Health Inspection Service (APHIS) and the State of Idaho have approved invertebrate plant feeders and plant pathogens that are proven natural control agents that suppress, inhibit, or control specific target invasive plant species. Biological control activities include collection of invertebrate plant feeders and pathogens, development of insectaries for collection, transportation and transplantation of parasitic invertebrate plant feeders and pathogens, and supplemental stocking of populations. Biological control agents are transported in containers that safely enclose the agent until release. Releases can be ground-based or aerial. Each release is equivalent to treating approximately five acres (USDA Forest Service 2014).

The treated areas would continue to be inventoried and monitored to determine the success of the treatments and when the released bio-control agents have reached equilibrium with the target species. Repeat visits may need to be made several times a season and over a series of years to determine if additional releases are needed or if a different agent needs to be released.

The use of biological control treatment usually results in delayed effectiveness, often requiring five to ten years for successful reduction of target invasive plant infestations. However, simultaneous increase of native vegetation often eliminates the need for restoration. Biological control is the preferred method in remote areas where access is limited, on high density extensive populations where other control methods may not be appropriate, on species where biological control agents are available and proven effective, and in conjunction with other control methods to reduce density of the target species. The use of biological control is common to all action alternatives.

Design Criteria

- Obtain Animal and Plant Health Inspection Service (APHIS) permit to Move Live Plant Pests, Noxious Weeds, or Soil for those agents when transportation across state lines is involved.
- Use only APHIS and State of Idaho approved biological control agents.
- Use Forest Service protocols for documentation of releases and monitoring and share release information with the Idaho State Department of Agriculture.
- To the extent practicable, collect biological control agents locally or from areas with similar climatic and weather conditions, land and soil types, and cover types to maximize successful establishment.
- Distribute biological control agents at the optimal season and life cycle stage to optimize the likelihood of successful establishment. Distribute quantities sufficient to optimize successful short-term establishment.

- For those agents that self-disperse poorly, actively assist the distribution throughout target infestations by redistribution (collecting and moving the agent to new locations).

Herbicide Application

This method involves the use of herbicides and associated adjuvants. Ground-based or aerial application of herbicides would be used based on (a) treatment objective and priority of the target invasive plant species, (b) accessibility, topography and the size of treatment area, (c) the expected efficiency and effectiveness of the method selected, (d) the risk for spread or invasion into other locations, and (e) potential to harm priority habitats and vegetation complexes such as those associated with threatened, endangered or sensitive species.

Four types of herbicide application would be used:

- **Spot spraying-**This method targets individual plants and the immediate area around them. Most spot spraying is usually done with a backpack sprayer. However, spot spraying may also be applied using a hose from a truck-mounted or OHV-mounted tank, or tanks mounted on pack animals. This is the most common herbicide application method.
- **Broadcast-**Herbicide is applied to cover an area of ground rather than individual plants. This method may employ a spray system mounted on a truck or OHV. Broadcast applications are used in areas where invasive plants occupy a large percentage of plant cover on the site, making spot spraying impractical.
- **Aquatic application-**This application method would be used in response to EDRR associated with aquatic invasive plant species. This method may employ spot or broadcast spray over the surface of or into water. Application methods may be from shore using use backpacks, truck-mounted or OHV-mounted tank, or from boats.
- **Aerial application-**This method would be used in areas where physical features, such as topography, restricted access, size and/or rate of spread of infestation, personnel safety, or other factors such as prohibitive unit cost of ground application occur. Invasive plants would be treated with herbicides through the use of helicopters.

The method of application would result in a variance in the amount of herbicide used on the landscape. For the purposes of this analysis, treated acres represent the perimeter of the invasive species infestation area that would be treated while applied acres are the actual area within the infestation covered by the invasive species. Broadcast methods of application have greater coverage of herbicide than do the more targeted method of spot spraying. The assumption used in calculating applied acres is that broadcast methods would result in treated acres approaching or equaling applied acres. Spot spray methods could be as low as 1 to 10% of the applied acres. For the purpose of this analysis, broadcast aerial application methods would be assumed to have 100% of applied herbicide to the treated area. For ground based applications, a mix of broadcast and spot spraying would be assumed to have up to 40% of applied herbicide to the treated area. The average applied acres for 2010 to 2012 was 18%. The 40% applied herbicide assumption provides for analysis of increased ground-based broadcast application methods.

The application rates and method depend on factors such as the target species, phenological stage, abundance and distribution of the target species, type of herbicide used, site condition, type of non-target vegetation, soil type, depth to the water table, the distance to open water sources, riparian areas, and sensitive plant species.

Herbicide formulations and mixtures could contain one or more of the active ingredients displayed Table 2-10. The range of application rates for each chemical is derived from Human Health and

Ecological Risk Assessments and the herbicide label. Additional herbicides may be added in the future at either the Forest Plan or project level through appropriate risk analysis, NEPA procedures, and ESA consultation (discussed in the adaptive management section).

Table 2-10: Herbicides and Application Settings Currently Used and Proposed for Use

Herbicide (Active Ingredient)[1]	Maximum Label Application Rate (AI[2] or AE[3]/AC[4])	Typical SCNF Application Rate (lbs. AI or AE/AC)	Application Setting			
			Upland	Riparian	Aerial	Aquatic
2,4-D amine	2.0 lbs ae /ac/app[5] 2 apps per year	0.5-2.0 lb./ac	X	X		
Aminopyralid	**0.11 lbs ae/ac/year**	**0.06 – 0.11 lb./ac**	**X**	**X**	**X**	
Chlorsulfuron	2.6 oz. product/ac/year (0.12 lbs ai/ac/year)	0.5 - 2.0 oz./ac (0.02 - 0.09 lb./ac)	X	X	**X**	
Clopyralid	0.5 lbs ae/ac/year	0.28 - 0.5 lb./ac	X	X	**X**	
Dicamba	1.0 lbs ae/ac/app 2 apps per year	0.75 - 2.0 lb./ac	X			
Glyphosate	1.7 lbs ae/ac/app ≤ 8.0 lbs ae/ac/year	0.35 -5.0 lb./ac	X	X		**X**
Imazapic	0.19 lbs ai/ac/year	0.1 - 0.19 lb./ac	X	X	**X**	
Imazapyr	**1.5 lbs ae/ac/year**	**0.5-1.0 lb./ac**	**X**	**X**		**X**
Imazamox	**0.5 lbs ae/ac/year**	**0.25-0.5 lb./ac**		**X**		**X**
Metsulfuron-methyl	4.0 oz. product/ac/year (0.15 lbs ai/ac/year)	1.0 - 3.0 oz./ac (0.04 - 0.11 lb./ac)	X	X	**X**	
Picloram	1.0 lbs ai/ac/year	0.5 - 0.75 lb./ac	X		**X**	
Sulfometuron methyl	8.0 oz. product/ac/year (0.37 lbs ai/ac/year)	2.0 - 6.0 oz./ac (0.09- 0.28 lb./ac)	X	X	**X**	
Triclopyr: triethylamine salt (TEA)	9.0 lbs ae/ac/year	4.5 - 6.0 lb./ac	X	X		**X**

[1]Herbicides and application settings in bold are specific to the Proposed Action Alternative
[2]AI=Active Ingredient [3]AE=Acid Equivalent [4]AC=Acre [5]app=Application

Adjuvants

Chemical control activities frequently utilize adjuvants in addition to herbicides for more effective control of target species. Adjuvants are compounds added to the herbicide solution to improve its performance. They can either enhance the activity of an herbicide's active ingredient (activator adjuvant) or offset any problems associated with its application (special purpose or utility modifiers). For example, some adjuvants increase herbicide effectiveness by reducing the surface tension of water, increasing the area of the plant covered by the solution and increasing the plant's uptake of the herbicide itself. They can be added during the manufacturing process or by the applicator as needed based on site conditions. A list of adjuvants used in the SCNF is in Appendix D.

Design Criteria

General Herbicide Application

- Herbicide application shall comply with applicable laws (Idaho Statute Title 22, Chapter 34 and Idaho Administrative Code Rule 02.03.03), Forest Service policy and guidelines (FSH 2109 and FSM 2150), Endangered Species Act (ESA) section 7 consultation requirements, National Pollutant Discharge Elimination System (NPDES) permit requirements, and with product label directions for the herbicide being used to assure worker safety and to manage potential impacts of herbicide application.
- Always read and follow label directions, including instructions for herbicide use, application rates, equipment and techniques, personal protective equipment for applicators and mixers, and container disposal .
- See Appendix E regarding application of herbicides in proximity to water.
- Prior to implementation, program managers would ensure proper permitting is in place.
- Make sure Material Safety and Data Sheets, safety plans, spill prevention plans and cleanup kits are available to applicators and mixers, per the requirements of FSH 2109.
- Keep accurate and detailed application records, per Idaho Department of Agriculture Rules Governing Pesticide and Chemigation Use and Application and EPA requirements identified in the NPDES.
- Perform herbicide applications by or under the direct supervision of licensed Idaho professional herbicide applicators for forest and contract crews, per Idaho Department of Agriculture Rules Governing Pesticide and Chemigation Use and Application.
- Ensure that contracts and agreements include all of these design criteria as a minimum.
- Monitor wind speed and direction and equipment and spray parameters throughout an herbicide application. No herbicide shall be applied in sustained wind conditions exceeding five (5) miles per hour in riparian areas or in any wind conditions exceeding product label directions.
- Herbicide applicators would obtain a weather forecast for the area prior to initiating a spraying project to ensure no extreme precipitation or wind events were predicted to occur during or immediately after spraying that could allow runoff or drift into water bodies.
- Conduct equipment and personnel inspections, equipment maintenance and equipment calibration as needed to ensure proper herbicide application and to meet regulatory requirements. Regularly check equipment and components for wear. Attend to repairs and parts replacement promptly.
- Transport only the quantity of herbicide and adjuvants needed for a project. Secure containers being transported in such a way to prevent the likelihood of spills. Make periodic checks en route to help avoid spillage. Carry herbicides and adjuvants in water-tight, floatable containers when supplies need to be carried over water by boat, raft or other watercraft.
- When out in the field, use practical measures to restrict access to herbicides and adjuvants and spray equipment by unauthorized personnel.
- Off-highway vehicles (OHVs) used to transport or spray herbicides are administratively allowed to travel off designated motorized routes. These vehicles would not be taken off designated routes if damage to soils could occur due to wet conditions. Take care to ensure that disturbance to desirable vegetation is minimized and that no visible “trail” creation occurs.

- Follow the procedures in the SCNF Spill Plan in the event of a spill. Keep the SCNF Spill Plan compliant with NPDES.
- Use indicator dye in the herbicide mix to visually assure uniform coverage and minimize overlapped or skipped areas and treatment of non-target areas. Indicator dyes will be water-soluble and non-toxic.
- Within areas of special concern, such as developed recreation, trailheads, campsites and other high human areas, utilize treatments methods that minimize potential exposure to the public.
- To minimize herbicide drift during broadcast operations, use low pressure and larger droplet size to the extent possible with the equipment being used. Use nozzles designed for herbicide application.
- Equip water drafting equipment with back siphoning prevention devices.
- Wherever possible, mix and load at a distance greater than 100 feet from water and where spilled materials will not flow into groundwater, wetlands or streams.
- No broadcast application methods are used in riparian areas.
- Provide herbicide "awareness" information to forest users as opportunities arise. Treatment areas will be signed prior to herbicide applications within areas of special concern, such as trailheads, campsites, and other high use areas. Make information on where and when spraying and other treatments would occur available to the public at the local Ranger District office. Forest Service and other websites may also be used for public notification.
- Grazing permittees will be made aware of annual treatment actions at the permittee annual operating instruction meetings and/or if requested, notified in advance of spray dates.
- Follow label directions and other information sources to apply herbicides to the target species during phenological stages that optimize target control.
- To the extent practicable, apply herbicides to infestations containing biological control agents at times when the effects of herbicides to the host plants would not interfere with the agent's life cycle.
- Use a spray pattern that avoids application of herbicide to non-target species.

Sensitive Species

- Evaluate sites considered for herbicide treatment for sensitive plant habitat suitability. Survey suitable habitat as necessary prior to treatment. The need for field surveys in suitable habitat is based on factors such as plant phenology at the time of treatment and species' susceptibility to the herbicide(s) being used.
- Mechanical treatment, individual plant treatment (e.g. wiping), or spot herbicide application are preferred methods when treating invasive plant infestations associated with sensitive plant populations.
- For identified sensitive plant populations, there would be a 50-foot no spray zone for all herbicides applied by broadcast-type spray equipment (e.g. vehicle or helicopter-mounted booms or boomless sprayers).
- Glyphosate would only be applied within a 50-foot buffer if the sensitive plant species is dormant. Remaining herbicides may be applied following label instructions.

Aerial Herbicide Application

- The Aerial Herbicide Application Coordination and Safety Implementation Plan would be followed (Appendix F).
- Provide a minimum buffer of 300 feet for aerial herbicide application around developed campgrounds and private land (unless otherwise authorized by adjacent private landowners).
- All live water (perennial streams, flowing intermittent streams, lakes, ponds, springs, and wetlands) would have a 300 foot no aerial application herbicide buffer.
- Aerial herbicide application would not occur in designated municipal watersheds. Idaho DEQ Source Protection Areas would not be included in aerial application project areas.
- Aerial herbicide applications would not occur in Research Natural Areas (RNAs) or proposed wilderness areas. No aerial application would occur within ¼ mile of Designated Wild, Scenic System River (includes Recreation classification) and rivers determined to be eligible for inclusion in the System.
- Aerial herbicide application would not occur over areas with >30% live tree canopy cover.
- Aerial herbicide application would not occur over whitebark pine stands.
- Within known or potential sage-grouse nesting/early brood-rearing habitat, any aerial herbicide application would occur after June 30.
- Helicopters would avoid known raptor nest sites when flying to and from treatment sites and no aerial herbicide application would occur within ½ mile from known raptor nest sites during the following periods (or until young have fledged):
    - April 1 through August 31
    - bald eagles - February 1 through August 15
- Aerial herbicide application would not occur when sustained wind speeds exceed 5 mph or label recommendations.
- Aerial herbicide applications would not occur during inversions, or below minimum relative humidity or above maximum temperature, as stated on label.
- Herbicide applicators would obtain a weather forecast for the area prior to initiating a spraying project to ensure no extreme precipitation or wind events were predicted to occur during or immediately after spraying that could allow runoff or drift into water bodies.
- Considerations for choosing sites for aerial application would include the extent of the invasive plant infestation, the cumulative size of the infestation (many small sites in close relative proximity of each other), and the density of the invasive species.
- Aerial treatment areas could be treated recurrently on a 2 or 3-year rotation to ensure effective control. Monitoring would show which areas would need to be re-treated or if treatment areas can be reduced based on effectiveness of previous treatment.
- Public notification would be conducted through press releases in local newspapers and the use of social media and websites which that identify the potential windows of treatment for specific areas. Signing and on-site layout would be performed one to two weeks prior to actual aerial treatment.
- Temporary area, trail, and road closures would be used to ensure public safety during aerial spray operations.
- Grazing permittees would be notified that aerial application would be conducted and of the specific time frames in which treatment would occur to allow the option to remove grazing animals from the area.

- Aerial spray units (and perennial seeps, ponds, springs, and wetlands in proposed aerial units) would be identified prior to spraying to ensure only appropriate portions of the unit are aerially treated. A GPS system would be used in spray helicopters and each treatment unit mapped before the flight to ensure that only areas marked for treatment are treated. Drift monitoring cards would be placed out to 300 feet from and perpendicular to perennial streams to monitor herbicide presence as needed (Appendix G).

Aquatic Herbicide Application

- Perform herbicide applications by or under the direct supervision of licensed Idaho professional herbicide applicators with Aquatic Pest Control certifications.
- Aquatic herbicide applications would not be applied aerially.
- When the product label recommends use of an adjuvant, only aquatic-approved adjuvant may be used.
- Conduct evaluation of the infested site to determine best control method, including (a) location, number and extent of infestations, (b) depth, flow, substrate, water quality and configuration of the water body involved, (c) density and diversity of native flora, and (d) direct and indirect effects to native flora and fauna and to people (e.g. domestic water use).
- Consider whether to apply herbicide to entire body of water, or to areas with highest risk as vectors, such as boat ramps.
- Use label to determine what proportion of water body may be treated at one time without causing excessive oxygen depletion from decaying plant matter.
- Do not apply to water where invasive plants are not present if herbicide is not labeled for submerged vegetation. Prefer spot-spraying techniques when applying herbicides to emergent vegetation.
- Notify the public of dates and type of treatment and duration of closure period.
- In the event of a detection of an aquatic nuisance plant species, the applicable sections of Idaho's Aquatic Nuisance Species Plan (ID ISCTC 2007) will be followed.

Manual and Mechanical Treatment Methods

Mechanical and manual treatments are typically used to remove seed heads, individual plants or small infestations. They may be used in sensitive areas to avoid impacts to non-target species or water quality, or to prevent seed production. Mechanical and manual approaches are slow and very labor intensive; they are effective only for small infestations.

The term "manual" defines treatments such as hand pulling or using hand tools, such as hand clippers, hoes, rakes, shovels, etc., to remove plants or cut off seed heads. Manual treatments can be effective for annual and tap-rooted invasive plant, but are ineffective against perennial invasive plants with deep underground stems or roots, or fine rhizomes that can be easily broken and left behind to re-sprout. Use of this method might need to be repeated several times throughout the growing season depending on the species. This treatment may require digging below the soil surface to remove the main root of plants.

The term "mechanical" refers to the use of equipment and power tools, including actions like mowing, torching (using a propane burner to kill invasive plants with heat), and weed whipping. Choosing the appropriate power tool depends on factors such as characteristics of the target weed

species (e.g. stem size or sprouting ability), the density of the target species and size of the infestation, site location and condition, and soil or topographic considerations. Mechanized treatments are typically used to remove flowering stems to prevent seed production or to reduce or remove above ground biomass. The use of manual and mechanical treatment methods is common to all action alternatives.

Design Criteria

- Obtain necessary state and federal permits, when and where required.
- Prior to any burning invasive species using a torching device, a prescribed burn plan will be completed and compliant with Forest Service Manual 5140 and the Interagency Prescribed Fire Planning and Implementation Procedures Guide, PMS 484.
- Consult an archaeologist prior to initiation of work to determine whether an archaeological survey is needed.
- Incidental weed pulling would not trigger Section 106 review, as there is a very low probability that it would have an adverse effect on an archaeological site.
- Minimize soil disturbance as much as possible to minimize germination of invasive plant seeds and bare soil.
- Avoid non-target species damage to the extent practicable. Select mechanical methods to effectively control the target species (e.g. grubbing/hoeing is inappropriate for rhizomatous species and may increase the density of the invasive plant population as root fragments sprout and become new plants).
- Apply mechanical treatments at the proper stage of plant growth when treatment will be most effective at controlling the target invasive plant.
- Thoroughly inspect and clean all equipment and clothing to remove invasive plant seeds or vegetative propagules to prevent the movement of the invasive plant to another site.
- To the extent practicable, conduct clipping and removal of seed stalks prior to seed maturity to reduce inputs to the seed bank or when seeds are easily picked up and transported by vectors such as wind, humans or animals.
- Specific to aquatic invasive plants, hand-pulling and/or smothering may be used when an infestation is very limited in extent and occurs close to the shoreline of a water body, but has not yet infested deeper waters.

Rehabilitation and Restoration

Sites that have been severely impacted by weeds can be devoid of desirable plant species or consist of only scattered individual relict plants. Soil erosion may have taken place. Ecosystem structure and function may no longer be in place (e.g. mycorrhizal relationships between plants and soil fungi). Natural revegetation can often be slow, but in cases where there are few or no desirable plant species to take the place of invasive plants, natural recovery may not take place at all. In such cases, management activities may be required to assist vegetation recovery and prevent soil erosion. In turn, the revegetation measures would impede the re-establishment of invasive plants on the site. The objective is to re-establish a desired plant community and a return to conditions that foster the recovery of natural ecosystem processes. Equipment that could be used during reseeding activities includes, but is not limited to, hand tools such as rakes or larger equipment such OHV-drawn harrows and aerial delivery. The utilization of rehabilitation and restoration actions is common to all action alternatives.

Design Criteria

- Natural revegetation is the preferred option whenever possible. Assess invasive plant-infested sites or areas of disturbance (e.g. wildfire) to determine if the area is capable of natural recovery after weed control treatments. Determine what mix of desirable or native grass and forb plants still occur on the site and if they are numerous and vigorous enough to be capable of spreading vegetatively or via seed production.
- Assess erosion processes that may be affecting the site and the degree of severity of any soil erosion.
- Consider the most effective, practical and suitable means of providing rehabilitative or restorative measures, whether eliminating sources of disturbance other than invasive plants, or taking actions such as seeding and/or mulching.
- Consider the need to control invasive annual grasses, such as cheatgrass, and forbs, such as annual mustards, that are known to compete aggressively with perennial seedlings trying to establish.
- Determine whether additional assistive measures may be required, such as cover crops, hydraulic mulches, and mycorrhizal inoculums.
- Follow the guidance for revegetation in FSM 2070- Vegetation Ecology
- Use native plants in rehabilitation and restoration where practicable.
- If it is determined that non-native species are the best choice for interim or permanent revegetation, be sure to select species that do not behave invasively under conditions similar to those at the site to be revegetated.
- Purchase only certified invasive plant-seed free seed. Consider the use of site-adapted seed, if available and practicable.
- When seeding, determine the need for site preparation and protective measures that may need to be taken to allow the seeding to establish successfully.
- Plan revegetation activities for the optimal season and site conditions for successful establishment.
- Design seed mixes, whether native or desirable species, that are adapted to site conditions (including soil type, precipitation patterns, plant hardiness zones, etc.).
- Sites where restoration and rehabilitation treatments have been applied may need to be protected from grazing use through temporary fencing, livestock exclusion or other method appropriate to the sites to allow seeded plant establishment.
- Following establishment, continue to practice proper vegetation management to maintain a healthy, functioning plant community that is resilient to disturbance and resistant to invasive plant re-invasion.
- Use only invasive plant seed-free mulches and other products for uses such as erosion control and improved seed germination.
- Ensure that treatment tools and other equipment are free of invasive plant seed before moving to or using on the project site.
- Minimize ground-disturbing activities to the extent possible during reseeding efforts.
- Conduct rehabilitation and restoration activities only in areas with slope gradients less than 45%.
- Conduct rehabilitation and restoration activities only in areas with low or moderate landtype erosion hazard ratings.
- Consult an archaeologist prior to initiation of work to determine if an archaeological survey is needed.

Monitoring

Monitoring is an integral part of any adaptive, integrated weed management program. Monitoring addresses prevention, EDRR, treatment, and restoration efforts, and informs future decision-making and strategy. Both quantitative and qualitative monitoring efforts are included in the overall monitoring program. Post-treatment reviews of monitoring data would occur on a sample basis to determine whether treatments were effective, the type and extent of damage which may have occurred to non-target species, whether design criteria were applied correctly, and if recovery occurred as expected.

Retreatment and active rehabilitation or restoration prescriptions would be developed as needed based on post-treatment results. Changes in treatment methods would occur based on effectiveness of treating the invasive plant infestations. For example, an invasive plant population treated with a broadcast herbicide may be retreated with a spot spray or hand pulled, once the size of the infestation and density of the seed bank are reduced. Monitoring is common to all action alternatives.

Implementation Monitoring

Program elements and site-specific projects should include the following to accomplish implementation monitoring:

- Develop a project work plan for herbicide use as described in FSH 2109.14.3. This plan would present organizational and operational details including treatment objectives, equipment, materials, and supplies needed; herbicide application method and rate; field crew organization and lines of responsibility, and a description of any interagency coordination. The plan would also include a job hazard analysis to assure applicator safety.
- Conduct site visits during work periods to monitor compliance.
- Initiate monitoring during implementation to ensure Project Design Features are implemented as planned. Document daily field conditions, activities, accomplishments and/or difficulties. Use contract administration mechanisms to correct contractor performance deficiencies.
- Document and report herbicide use, certified applicator information, invasive infestation information and inventories, and invasive treatments using the database of record to record the amount, type and location of herbicide use annually.
- For biological control releases, monitor a selection of biological control release sites annually, tracking agent establishment and target species' response, to determine the efficacy of the release.
- For aquatic herbicide applications, obtain, as required, pre- and post-treatment water quality data for water chemistry, impacts to fauna and to non-target flora and response of the aquatic invasive plant species to treatment.
- For mechanical treatments, monitor rehabilitative and restoration measures throughout the recovery process to quickly identify and correct any problems that may impede successful revegetation.

Effectiveness Monitoring

Effectiveness monitoring generates data that aids managers in assessing trends in infestation number, size, and density, the effective of noxious and invasive plant infestations on native vegetation, the effect of treatments on target and non-target species, and the effectiveness of

treatments as implemented. Effectiveness monitoring must be done at multiple scales in order to provide the best insight into the effects of treatment actions. All treatment methods (manual, biological, and chemical) are subject to effectiveness monitoring.

- Monitor size, density, and other biological characteristics of invasive plant infestations.
    - Maintain noxious and invasive plant inventories in the appropriate database of record.
- Evaluate immediate and short-term impacts of treatment on target invasive plants and non-target vegetation.
    - Monitor and document observations of treated sites as practicable in accordance with established guidelines.
- Evaluate long-term effects of treatment on target invasive plants and non-target vegetation.
    - Establish permanent monitoring plots for long-term site assessment.
    - Monitor survival, distribution, and effectiveness of biological control agents.

2.2.4. Alternative 4-No Aerial Herbicide Application

This alternative is identical to the Proposed Action alternative with the exception that there would be no aerial application of herbicides. All design criteria, except those specific to aerial application, would apply to this alternative.

2.2.5. Alternative 5-No Aquatic Herbicide Application

This alternative is identical to the Proposed Action alternative with the exception that there would be no aquatic application of herbicides. All design criteria, except those specific to aquatic herbicide application, would apply to this alternative.

2.2.6. Alternatives Considered but Eliminated from Detailed Study

Federal agencies are required by NEPA to rigorously explore and objectively evaluate all reasonable alternatives and to briefly discuss the reasons for eliminating any alternatives that were not developed in detail (40 CFR 1502.14). Public comments received in response to the Proposed Action provided suggestions for alternative methods for achieving the purpose and need. Some of these alternatives may have been outside the scope of invasive plant treatment, duplicative of the alternatives considered in detail, or determined to be components that would cause unnecessary environmental harm. Therefore, a number of alternatives were considered, but dismissed from detailed consideration for reasons summarized below.

Ecosystem Recovery

One commenter suggested we consider an Ecosystem Recovery Alternative. This alternative concentrated on preventing conditions that favor exotic vegetation problems and restoration of ecological integrity. The alternative identified site selection and treatment priorities; prevention vegetation treatments by land use activity; restoration vegetation treatments by land use activities; revegetation; monitoring and evaluation; tribal relations regarding vegetation treatments; and coordination, education, and public awareness. Many of the suggestions are included in the FEIS and analysis- a prevention plan, which incorporates public education; treatment prioritization criteria; treatment methods and design criteria; restoration methods and design criteria; implementation and effectiveness monitoring; and tribal coordination and consultation.

Many of the active and passive restorations actions suggested involved programs and activities that are beyond the treatment of invasive plants. This alternative was not given detailed analysis because making changes to land use, Forest Plan direction, travel management, and permitted activities on the SCNF are outside the scope of this analysis.

No Herbicide

Some people believe herbicides may present a risk to humans, wildlife, and native vegetation. Although herbicides proposed for invasive plant control in the Proposed Action have gone through rigorous scientific testing and government approval, some commenters perceive use of these herbicides as unsafe. A No Herbicide Alternative differs from the No Action Alternative because the No Action Alternative allows for no mechanical or biocontrol treatment of invasive plants.

Several noxious weeds found in the SCNF have no effective mechanical and/or biological controls available (Table 2-9). Others have extensive infestations where mechanical treatment methods would not be physically possible to accomplish. The cost of mechanical treatments, such as hand-pulling or mowing would be prohibitively expensive and not enough acres could be treated to address the Purpose and Need. A “no herbicide” alternative does not comply with the agency’s Integrated Pest Management direction and is not consistent with regulations that noxious weeds be managed on National Forests.

Prescriptive Grazing

The use of domestic goats to treat invasive plant infestations is a well-established strategy. However, due to the potential for disease transmission from domestic goats to bighorn sheep, national and regional Forest Service direction has forests conduct bighorn sheep risk assessments using viability analysis.

This alternative is not further analyzed since bighorn sheep are present on all Ranger Districts in the SCNF. This does not preclude analysis of goat grazing at a project level under NEPA examinations separate of this Invasive Plant Treatment FEIS. Spatial and/or temporal separation between domestic goats and bighorn sheep can be used to manage the risk of disease transmission. Analysis at a project level would allow for site specific risk assessments and viability analyses.

2.3. Comparison of Alternatives

Table 2-11 shows the difference of treatment methods and acres treated between alternatives. Measurement indicators specific to different resources are discussed in the Environmental Consequences section in Chapter 3.

Table 2-11: Invasive Plant Treatment FEIS Alternative Comparison

	Alt. 1 No Action	Alt. 2 Current Action	Alt. 3 Proposed Action	Alt. 4 No Aerial Herbicide Application	Alt. 5 No Aquatic Herbicide Application
% of Project Area proposed for annual treated acres	0	Not specified	0.006	0.006	0.006
% of Project Area proposed for annual applied acres	0	0.002	0.004	0.002	0.004
Treatment Method[1]					

	Alt. 1 No Action	Alt. 2 Current Action	Alt. 3 Proposed Action	Alt. 4 No Aerial Herbicide Application	Alt. 5 No Aquatic Herbicide Application
Bio-control	No	Yes	Yes	Yes	Yes
Treated Acres	0	400[2]	2,000	2,000	2,000
# Releases	0	80	400	400	400
Chemical	No	Yes	Yes	Yes	Yes
Treated Acres	0	Not specified	16,000	16,000	16,000
# of Herbicides	0	10	13	13	13
Ground Application	**No**	**Yes**	**Yes**	**Yes**	**Yes**
Treated Acres	0	Not specified	8,000	16,000	16,000
Applied Acres	0	5,500[4]	3,200[3]	6,400[3]	3,200[4]
Aerial Application	**No**	**No**	**Yes**	**No**	**Yes**
Treated Acres	0	0	8,000	0	8,000
Applied Acres	0	0	8,000	0	8,000
Aquatic Application	**No**	**No**	**Yes**	**Yes**	**No**
Applied Acres	0	0	TBD	TBD	0
Total Herbicide Applied Acres		**5,500**	**11,200**	**6,400**	**11,200**
Mechanical/Manual	No	Yes	Yes	Yes	Yes
Treated Acres	0	40[5]	2,000	2,000	2,000

[1]All numbers represent the maximum annual amount
[2]These are the average acres; there is no identified upper bound
[3] How acres derived:

- Aerial application=broadcast application: treated acres=applied acres (assume 100% of treated area has herbicide applied).
- Ground application= broadcast and spot application (assume 40% of treated area has herbicide applied).
- Proposed Action:
  - No more than 50% of treated acres will use aerial application (8,000 acres= treated and applied)
  - Remaining 8,000 acres would have 3,200 applied acres (8,000*0.4)
  - Total applied acres: 8,000+3,200=11,200
  - Any portion of the applied aerial acres not utilized could be used for applied ground acres (i.e. if 4,000 acres aerially applied=8,800 applied acres; if 2,000 acres aerially applied = 7,600 applied acres; if 0 acres aerially applied = 6,400 applied acres)
- No Aerial:
  - Applied acres: 6,400 (16,000*0.4)

[4] Specified in NMFS 2012 Biological Opinion
[5] Not specified, but not prohibited.

2.3.7. Comparison of Issues by Alternative

Table 2-12: Soil and Water Comparison of Issue by Alternative

Measurement Indicator	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Instream Sediment Load	Long term increase	Minimal short term increase; Slight long term increase	Minimal short term increase; Long term decrease	Minimal short term increase; Possible slight long term	Minimal short term increase; Long term decrease

Measurement Indicator	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
				increase	
Herbicide Concentrations in Water	None	Minimal	Minimal	Minimal	Minimal
Riparian Function	Large increase in infested acres; Long term impairment	Slight increase in infested acres; Gradual long term decline in function	Decrease in infested acres; Long term improvement	Decrease in infested acres; Long term improvement	Decrease in infested acres; Long term improvement
Soil Condition	Long term impairment	Slight short term impairment; Gradual long term decline in condition	Slight short term impairment; Long term improvement	Slight short term impairment; Gradual long term decline in condition	Slight short term impairment; Long term improvement

Table 2-13: Fisheries Comparison of Issue by Alternative

Measurement Indicator	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Effect of Herbicide on ESA/Sensitive/Management Indicator Species					
Biological	N/A	NLAA/MII	NLAA/MII	NLAA/MII	NLAA/MII
Manual and Mechanical	N/A	NLAA/MII	NLAA/MII	NLAA/MII	NLAA/MII
Herbicide	N/A	NLAA/MII	NLAA/MII	NLAA/MII	NLAA/MII
Adequacy of Design Criteria	N/A	Yes	Yes	Yes	Yes

NLAA- Not likely to adversely affect ESA-listed species
MII- May impact individual R4 sensitive species

Table 2-14: Wildlife Comparison of Issue by Alternative

Measurement Indicator	Alt. 1	Alt. 2		Alt. 3, 4, 5	
Toxicity potential of herbicides	N/A	**Acute[1]**	**Chronic[2]**	**Acute**	**Chronic**
		4 herbicides-No exceedance of LOC for any exposure scenario	6 herbicides-No exceedance of LOC for any exposure scenario	7 herbicides-No exceedance of LOC for any exposure scenario	8 herbicides-No exceedance of LOC for any exposure scenario
		4 herbicides-Exceedance of LOC for 1 to 2 exposure scenarios	2 herbicides-Exceedance of LOC for 1 exposure scenario	4 herbicides-Exceedance of LOC for 1 to 2 exposure scenarios	3 herbicides-Exceedance of LOC for 1 exposure scenario
		2 herbicide-Exceedance of LOC for 4 to 6 exposure scenarios	2 herbicide-Exceedance of LOC for 3 exposure scenarios	2 herbicides-Exceedance of LOC for 4 to 6 exposure scenarios	2 herbicides-Exceedance of LOC for 3 exposure scenarios
Adequacy of Design Criteria	N/A	Yes	Yes	Yes	Yes

Measurement Indicator	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
ESA/ R4Sensitive Wildlife Species Comparison of Issue by Alternative					
Yellow-billed cuckoo	MII	NII	NII	NII	NII
Greater sage-grouse	MII	MIIB	MIIB	MIIB	MIIB
Canada Lynx	NLAA	NLAA	NLAA	NLAA	NLAA
Gray Wolf	MII	MIIB	MIIB	MIIB	MIIB
Wolverine	MII	MIIB	MIIB	MIIB	MIIB
Fisher	MII	MIIB	MIIB	MIIB	MIIB
Bighorn sheep	MII	MIIB	MIIB	MIIB	MIIB
Spotted bat	MII	MIIB	MIIB	MIIB	MIIB
Townsend's big-eared bat	MII	MIIB	MIIB	MIIB	MIIB
Pygmy rabbit	MII	MIIB	MIIB	MIIB	MIIB
Bald eagle	MII	NI	NI	NI	NI
Northern goshawk	MII	MIIB	MIIB	MIIB	MIIB
Peregrine falcon	MII	MIIB	MIIB	MIIB	MIIB
Boreal owl	MII	MIIB	MIIB	MIIB	MIIB
Flammulated owl	MII	MIIB	MIIB	MIIB	MIIB
Great gray owl	MII	MIIB	MIIB	MIIB	MIIB

Measurement Indicator	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Three-toed woodpecker	MII	MIIB	MIIB	MIIB	MIIB
Harlequin duck	MII	MII	MIIB	MIIB	MII
Columbia spotted frog	MII	MII	MIIB	MIIB	MII

[1] Acute- 12 exposure scenario; [2] Chronic- 9 exposure scenarios
NLAA: Not likely to adversely affect; NII: No Impact to individuals; MII: May impact individuals; MIIB: May impact individuals beneficially

Table 2-15: Sensitive Plants Comparison of Issue by Alternative

Measurement Indicator	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Treatment Method Effect on R4 Sensitive Plants[1]					
Biological control	MIIH	NII; BIH	NII; BIH	NII; BIH	NI; BIH
Herbicide application	MIIH	MII; BIH	MII; BIH	MII; BIH	MII; BIH
Mechanical control	MIIH	MII; BIH	MII; BIH	MII; BIH	MII; BIH

NII: No Impact to individuals; MII: May impact individuals; BIH: Beneficially impact habitat; MIIH: May impact individuals and habitat
[1]Sensitiv plant species not present in project are have NII determinations

Table 2-16: Human Health Comparison of Issue by Alternative

Measurement Indicator	Alt. 1	Alt. 2		Alt. 3, 4, 5	
Toxicity Potential of Herbicides by Route of Exposure	N/A	Worker	Public	Worker	Public
		5 herbicides- No exceedance of LOC	3 herbicides- No exceedance of LOC	8 herbicides- No exceedance of LOC	6 herbicides- No exceedance of LOC
		4 herbicides- No exceedance of LOC at typical application rates	1 herbicide- No exceedance of LOC at typical application rates	4 herbicides- No exceedance of LOC at typical application rates	1 herbicide- No exceedance of LOC at typical application rates
		1 herbicide- Exceedance of LOC at typical application rate	2 herbicides- Exceedance of LOC at typical application rate	1 herbicide- Exceedance of LOC at typical application rate	2 herbicides- Exceedance of LOC at typical application rate
			3 herbicides- Exceedance of LOC at maximum application rate		3 herbicides- Exceedance of LOC at maximum application rate
			1 herbicide- Exceedance of LOC at typical		1 herbicide- Exceedance of LOC at typical

Measurement Indicator	Alt. 1	Alt. 2		Alt. 3, 4, 5	
			application rate		application rate
Adequacy of Design Criteria	N/A	Yes	Yes	Yes	Yes

LOC- Level of concern

Table 2-17: Recreation Comparison of Issue by Alternative

Measurement Indicator	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Effects to Visual Resources	Negative	Short-term negative; generally positive	Short-term negative; positive overall	Short-term negative; generally positive	Short-term negative; generally positive
Effects to Wild and Scenic River (WSR) Designated and Eligible Streams	Negative effects to ORVs	Positive effects to ORVs	Positive effects to ORVs	Positive effects to ORVs	Positive effects to ORVs
Effects to Idaho Roadless Areas	Generally negative	Somewhat positive	Generally positive	Generally positive	Generally positive

ORVs- Outstandingly remarkable values

Table 2-18: Economics Comparison of Issue by Alternative

Measurement Indicator	Alt. 1 No Action	Alt. 2 Current Action	Alt. 3 Proposed Action	Alt. 4 No Aerial Treatment	Alt. 5 No Aquatic Treatment
Average Cost of Treatment per Acre	0	$134	$80	$134	$80

Chapter 3. Affected Environment and Environmental Consequences

3.1. Introduction

This chapter describes the existing conditions of the project area by resource and the environmental effects of implementing the alternatives described in Chapter 2. Effects are defined as:

- Direct- impacts, which can range from adverse to beneficial, occur at the same time and place and are caused by the action.
- Indirect-adverse or beneficial impacts which occur later at time and farther removed in distance and are caused by the action.
- Cumulative: incremental impacts that result from the action when added to other past, present, and reasonably foreseeable actions regardless of which agency or persons undertake the activities.

3.1.1. Herbicide Risk Assessments

The effects of herbicide use depend on the toxicity of the herbicide, the level of exposure to that herbicide, and the duration of that exposure. Risk assessments evaluate the potential effects to non-target plants, wildlife, human health, soils, and aquatic organisms from the herbicides considered for use in the Salmon-Challis National Forest (SCNF). The Forest Service contracted with Syracuse Environmental Research Associates, Inc. (SERA) to evaluate human health and ecological effects of herbicides using Environmental Protection Agency (EPA) studies and other peer-reviewed articles from the open scientific literature. Information from laboratory and field studies of herbicide toxicity, exposure, and environmental fate was used to estimate the risk of adverse effects to non-target terrestrial and aquatic organisms, humans, water, and soil. Table 3-1 identifies the risk assessments available by active ingredient.

Table 3-1: Risk Assessments for Herbicides Analyzed

Herbicide (Active Ingredient)	Date Final	Risk Assessment Reference
2,4-D amine	September 30, 2006	USDA Forest Service
Aminopyralid	June 8, 2007	SERA TR-052-04-04a
Chlorsulfuron	November 21, 2004	SERA TR 04-43-18-01c
Clopyralid	December 5, 2004	SERA TR 04-43-17-03c
Dicamba	November 24, 2004	SERA TR 04-43-17-06d
Glyphosate	March 25, 2011	SERA TR-052-22-03b
Imazamox	December 10, 2010	SERA TR-052-24-02a
Imazapic	December 23, 2004	SERA TR 04-43-17-04b
Imazapyr	December 16, 2011	SERA TR-052-29-03a
Metsulfuron-methyl	December 9, 2004	SERA TR 04-43-17-01c
Picloram	September 29, 2011	SERA TR-052-27-03a
Sulfometuron methyl	December 14, 2004	SERA TR 03-43-17-02c
Triclopyr: triethylamine salt (TEA)	May 24, 2011	SERA TR-052-25-03a

In addition to the analysis of potential hazards from the active ingredients in the herbicides, SERA Risk Assessments evaluated available scientific studies of potential hazards of other substances associated with herbicide applications: impurities, metabolites, inert ingredients, and adjuvants. There is usually less toxicity data available for these substances (compared to the herbicide active ingredient) because they are not subject to the extensive testing that is required for the herbicide active ingredients under the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA).

Risk assessments are a qualitative evaluation of the probability that the use of an herbicide may pose a risk to human health or the environment (Forest Service Manual (FSM) 2150.5). The risk assessments contain:

- Hazard Characterization- What are the dangers inherent with the active ingredient?
- Exposure Assessment- Who could come into contact and how much?
- Dose Response Assessment- How much is too much?
- Risk Characterization- Indicates whether or not there is a plausible basis for concern.

The risk assessments considered worst-case scenarios including accidental exposures and application at maximum label rates. Although the risk assessments have limitations, they represent the best science available. The risk assessment methodologies and detailed analysis is incorporated into references of conclusions about herbicide toxicology in this document.

Risk assessments have a degree of uncertainty in interpretation and extrapolation of data. Uncertainty may result from a study design, questions asked, data collection, data interpretation, and extreme variability associated with aggregate effects of natural and synthesized chemicals on organisms, including humans, and with ecological relationships. Numbers used, particularly in ecological realms, are uncertain, and there are limits on our ability to understand or demonstrate causal relationships. Because of data gaps, assessments rely heavily on extrapolation from laboratory animal tests (SERA 2007c). Regardless of disadvantages and limitations of ecological and human health risk assessments, risk assessments can determine (given a particular set of assumptions) whether there is a basis for asserting that a particular adverse effect is plausible. The bottom line for all risk analyses is that absolute safety can never be proven and the absence of risk can never be guaranteed (SERA 2007c).

3.1.2. Project Area

The project area includes 3,119,035 acres, covering the entire Salmon-Challis National Forest, exclusive of the Frank Church-River of No Return Wilderness. This project area was divided into the following five Weed Management Areas: Lemhi (329,446 acres), North (418,364 acres), Pahsimeroi-Lost (1,061,805 acres), Upper Salmon (650,802 acres), and Salmon (658,618 acres). The SCNF is located in the Middle Rocky Mountain Ecoregion, which is comprised of the Blue Mountains of Oregon, the Southwestern Montana mountain ranges and the Salmon River Mountains of central Idaho (Bailey 1980 and 1995; and Parks et al. 2005). This ecoregion consists of mountain ranges, basins and river canyons. The climatic regime is broadly similar across the ecoregion, although precipitation varies based on altitude; overall, the ecoregion is semi-arid. Lower elevations are dominated by grasslands and shrub steppe vegetation while conifer cover increases with elevation. Ponderosa pine and Douglas-fir dominate low elevation conifer forest. Lodgepole pine, Engelmann spruce and subalpine fir occupy the mid-elevation range while whitebark pine occupies the upper elevations.

3.1.3. Basis for Cumulative Effects Analysis

Human activities are known to have influenced the spread of invasive plants into North America, the Pacific Northwest and specific sites within the project area. A list of ongoing activities and foreseeable future projects are available in Appendix H. Many of these activities have the potential to introduce or spread invasive plants. Permitted activities have stipulations, such as prevention measures included in grazing allotment annual operating instructions, timber sale contracts, and mineral material plans of operation. The recent update of the SCNF travel management plan eliminated cross country motorized travel, which eliminated a substantial potential for introducing or spreading noxious invasive species. The acres of wildfire illustrate the disturbed acres that have the potential for noxious plant invasion. Although the possibility for the increase of infestations (e.g. wildfire) as well as for the decrease (e.g. elimination of cross country motorized travel) exists for virtually any activity that occurs in the SCNF, the maximum number of acres that would be treated are identified in the alternatives would not change based upon these activities. The potential for cumulative effects resulting from treatment activities are discussed in the analysis for each resource.

3.1.4. Environmental Justice

Executive Order (EO) 12898- Federal Actions to Address Environmental Justice to Minority Populations and Low-Income Populations- directs agencies to"make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations", including tribal populations (EPA 2013).

Guidance for definition of minority and low-income populations states that such populations may be present if the percentage is "meaningfully greater" than the general population of other "appropriate unit of geographic analysis" (EPA 1998). The demographics of the three counties in which the proposed action would take place were compiled from 2012 Census Bureau Data (USDC CB 2012). The unit of geographic analysis used was the State of Idaho. No minority or low income populations that would have disproportionately high and adverse effects resulting from the proposed action were identified.

Table 3-2: County-wide Demographic Information

Population Demographics	State of Idaho	Butte County	Custer County	Lemhi County
Population (2012)	1,595,590	2,740	4,331	7,758
White alone	93.8%	96.6%	97.4%	96.2%
Black or African American alone	0.8%	0.4%	0.2%	0.5%
American Indian alone	1.7%	0.6%	0.6%	0.9%
Asian alone	1.4%	0.3%	0.3%	0.4%
Native Hawaiian or other Pacific Islander alone	0.2%	0.2%	0.1%	--
Two or more races	2.2%	1.9%	1.4%	1.9%
Hispanic or Latino	11.6%	4.5%	4.4%	2.7%
White alone, not Hispanic or Latino	83.5%	92.4%	93.3%	94.0%
Economic Demographics				
Households	577,648	1,101	1,878	3,716
Median household income (2012)	$47,015	$40,150	$41,698	$36,372
Per capita money income in past 12	$22,581	$20,866	$23,509	$23,351

Population Demographics	State of Idaho	Butte County	Custer County	Lemhi County
months (2008-2012)				
Persons below poverty level (2008-2012)	15.1%	14.3%	18.7%	21.2%

Aspects of the requirements of EO 12898 are addressed elsewhere in this analysis. The impacts of the proposed action and alternatives on human health and tribal consultation are analyzed below.

3.2. Vegetation

3.2.1. Introduction

The vegetation section analyzes the impacts of invasive plant invasion to native plant communities, the current extent of invasive plant infestations in the project area, current management actions, and the potential effects of the No Action alternative and the various action alternatives to invasive plant invasion and spread and to non-target vegetation.

3.2.2. Measurement Indicators

The vegetation measurement indicators used in this analysis include:

1. Treatment methods available for use:
    a. Biological Control
    b. Herbicide
        i. Terrestrial Application
            1. Ground-based application
            2. Aerial Application
        ii. Aquatic Application
    c. Mechanical
2. Number of Herbicides Available for Use
3. Treatment Acres by Method
    a. Numbers of biological control releases
    b. Acres of terrestrial herbicide application
    c. Acres of aerial herbicide application
    d. Acres of mechanical control

The number of agents in a release does not alter the 5-acre treatment rule. There is a direct relationship between the number of biological control releases and the number of acres treated. This relationship exists because of Forest Service business rules that specify that each release of biological control agents will be counted as five acres treated (USDA Forest Service 2014).

It is not possible to set an upper acreage limit for aquatic invasive plant control since there are no known infestations in the project area at present. For that reason, acres of aquatic invasive plant control are not being carried forward as a measurement indicator since it cannot be quantified. However, it is anticipated that early detection and control would allow for treated acres to be kept to a minimum.

3.2.3. Compliance with Forest Plan and Other Relevant Direction

The federal government recognizes the serious economic and environmental threats posed by the establishment and spread of invasive plants across public and private lands (Westbrooks 1998). The regulatory authority for managing invasive species, including noxious weeds comes from:

- The Federal Noxious Weed Act of 1974 (Public Law 93-629, as amended by the 1990 Farm Bill and as superseded by the Plant Protection Act of 2000)
- The 1990 US Farm Bill (Public Law 101-624, Title 14 – Conservation, Sub-title D), Presidential Executive Order 13112 (1999)
- The Plant Protection Act of 2000 (Public Law 106-224)
- The Noxious Weed Control and Eradication Act of 2004 (Public Law 108-412)

As a federal land management agency, the Forest Service is responsible for implementing the federal government's responsibilities for invasive plant management on National Forest system lands. The Forest Service spells out national, regional and local responsibilities through Forest Service manual direction (USDA Forest Service, FSM 2900 2011a) and through national and regional strategic frameworks and management plans (USDA Forest Service, 2013; USDA Forest Service, Intermountain Region, 2014).

The Forest Service is directed to practice an adaptive, collaborative and integrated approach to invasive species management (USDA Forest Service, FSM 2900 2011a, USDA Forest Service 2013a). This approach, often known as integrated weed management (IWM), addresses weed management strategies in terms of economic or environmental impacts from non-native invasive plants and deviations from desired conditions. IWM incorporates a number of elements, including four broad control strategies: biological, chemical, cultural, and mechanical. IWM also incorporates several other fundamental elements of successful invasive plant management, including prevention and monitoring. Importantly, IWM is an adaptive, iterative method that assesses response to management actions and makes adjustments to management strategies in response to feedback from monitoring.

The Forest Service's National Strategic Framework for Invasive Species Management (USDA Forest Service, 2013) has a four-pronged approach, including (1) prevention, (2) detection(3) control and management and, (4) rehabilitation and restoration. EDRR includes management actions associated with the Framework Elements for Detection and Control and Management The Forest Service places emphasis on protecting plant communities from invasive plants by preventing the establishment and spread of invasive plants into areas that are not infested. Prevention is the most effective and cost-efficient means of invasive plant management. Prevention helps to maintain healthy native plant communities, soil stability, watershed function, and habitat for fish and wildlife species.

Region 4 adheres to and emphasizes national direction in its Invasive Species Management Strategy (USDA Forest Service, Intermountain Region, 2014) Region 4 directs Forests to comply with the national strategic framework for management of invasive species and offers concrete guidance for integrated weed management objectives. The Proposed Action, , is intended to fully align the SCNF's invasive plant management with current national and regional direction.

The Salmon and Challis Land and Resource Management Plans' long-range goals and objectives for invasive plant management date from the late 1980s and do not reflect the current national and

regional direction regarding adaptive management or emphasize all elements of integrated weed management. Nonetheless, the Forest's Land and Resource Management Plans do provide basic guidance.

The Salmon National Forest Land and Resource Management Plan (LRMP) (1988) states that noxious weeds are to be controlled using integrated pest management techniques to protect and enhance other resources and to comply with Idaho State law. A sufficient amount of acreage is to be treated to ensure the eradication of new infestations, prevent the spread of existing infestations to adjacent lands and to gradually eliminate existing infestations. The SNFLRMP specifies that "Integrated Pest Management, the concept of using interdisciplinary expertise to plan for and implement a control program using a combination of biological, mechanical, chemical and preventive management will be emphasized" (USDA Forest Service 1988).

Under the Range Management section, a Salmon National Forest LRMP goal is to control noxious weeds as needed to protect the value of other resources and to comply with Idaho State law. The Range Management standards and guidelines directs the Salmon National Forest to treat noxious farm weeds in the following priority:

- leafy spurge and Russian and spotted knapweed, yellow star thistle and musk thistle
- invasion of new plant species classified as noxious farm weeds
- infestations in new areas
- expansion of existing infestations of Canada thistle and other noxious farm weeds
- reduce the acreage of current infestation

In 1988, the Salmon National Forest LRMP set an objective to "complete approximately 60 acres of noxious weed control treatments annually".

Under the Range Management section of the Challis National Forest LRMP (USDA Forest Service 1987), the following goals and objectives are specified:

- Maintain noxious weed control program at or above current level.
- Update noxious weed infestation map and control plan annually in conformance with the integrated pest management policy. Continue modest investment in noxious weed and poisonous plant control. Emphasize education and information programs for persons who use herbicides or pesticides on the Challis National Forest

The Challis National Forest LRMP further specifies standards and guidelines that direct noxious weed management:

- Develop and maintain a coordinated program for control of selected noxious farm weeds.
- New infestations and areas where noxious farm weeds are spreading will receive first priority for treatment.
- Activities that create or provide for the establishment of noxious weeds will be required to provide for their control.
- Machine application of herbicide in the treatment of vegetation will not be permitted in riparian areas or where it might contaminate water courses or impact riparian vegetation.

The Salmon National Forest LRMP and the Challis National Forest LRMP intend that herbicides will be used as an important component of invasive plant control. The Federal Insecticide, Fungicide and Rodenticide Act (FIFRA 1947, as amended) established the US system of pesticide regulation to protect applicators, consumers and the environment. It is administered by the Environmental Protection Agency (EPA) and the appropriate environmental agencies of the respective states. The FIFRA requires registration for all herbicides, after extensive testing to evaluate whether a pesticide has the potential to cause adverse effects on humans, wildlife, fish, and plants, including endangered species and non-target organisms, as well as possible contamination of surface water or ground water from leaching, runoff, and spray drift. When registered, a label is created to instruct the applicator on the proper usage of the material and required personal protective equipment. EPA also must approve the language that appears on each herbicide label and the product can only be used legally according to the directions on the labeling accompanying it at the time of sale (FIFRA 1947, as amended). The Forest Service is authorized by the FIFRA and the Cooperative Forestry Assistance Act to use pesticides for multiple-use resource management and maintenance of the quality of the environment as long as the actions comply with the National Environmental Policy Act (NEPA) and the Council on Environmental Quality (CEQ) regulations. Forest Service Manual 2150 provides direction on safe use of pesticides, including direction on storage and transport, and development of safety plans and emergency spill plans.

3.2.4. Methodology for Analysis

The techniques and methodologies used in this analysis consider pertinent available science. The analysis includes a summary of credible scientific evidence which is relevant to evaluating reasonably foreseeable impacts. The analysis also identifies methods used and references the scientific sources relied on. The conclusions are based on a scientific analysis that shows a thorough review of relevant scientific information.

The relevant science for this analysis consists of these elements:

- Scientific literature: Relevant literature was used for understanding of potential effects.
- Methods: The methods used to develop data for quantitative analysis was accomplished using software developed by Environmental Systems Research Institute (ESRI). Three types of operations were used- attribute queries, spatial queries and generation of new datasets from the original Forest Service GIS corporate data. The degree of spatial analysis range from simple queries about the spatial events to more complicated combinations of attribute queries, spatial queries and alterations of corporate data to create new layers for the purpose of this analysis.
- Experience: The collective knowledge of the project by interdisciplinary (ID) Team members through integration of science with local conditions.

The potential effects of invasive plant control methods are predictable and well-documented. On the basis of the foregoing, it is our determination that we have considered science relevant to the effects of this project on vegetation of the SCNF within the project area.

Not all non-native plants are considered deleterious to the environment and subject to eradication efforts as defined by federal and state weed management requirements (USDA Forest Service 2013). Management activities proposed by the SNCF deal only with invasive plants identified as damaging

to human health, economic interests or to the environment by county, state, or federal entities (Executive Order 131112).

The State of Idaho has declared 68 non-native, invasive aquatic and terrestrial plant species as noxious (Appendix A). Only 23 of these are known to infest lands within the project area. However, the remaining species are present elsewhere in Idaho or neighboring states and have the potential to become established in the project area. One additional species, sulfur cinquefoil (*Potentilla recta*), has been identified by Lemhi County and is included in this analysis (Table 2-9). In addition, the SCNF watches for non-native invasive plant species that could be transported into the project area (Appendix A). The SCNF also tracks a number of non-native invasive plant species that may not be listed as noxious in Idaho or other western states, but which are recognized as causing economic or environmental harm. This analysis incorporates management activities for (a) all 68 plant species legally designated as noxious weeds by the State of Idaho, (b) Lemhi County-designated noxious weed species, (c) the SCNF Watch List species, and (d) other non-native invasive plants that cause economic or environmental harm.

Since invasive plant management results may vary based on soils, vegetation (i.e. cover type), and climatic regime, the effects of invasive plant management for the action alternatives are based on local and regional information from sites that best represent the conditions found in the SCNF. Vegetation measurement indicators that help inform the analysis include acreage infested by invasive plants, and the relative risk of non-target vegetation impacts associated with weed control methods (Appendix I).

Analysis Area

The project area forms the area of analysis for vegetation for all alternatives. The area of analysis for cumulative effects to vegetation resources includes all of Butte, Custer, Lemhi counties and that portion of the Frank Church-River of No Return Wilderness managed by the SCNF.

3.2.5. Affected Environment

3.2.5.1. Existing Conditions

Native Plant Communities in the SCNF

The SCNF contains a diverse and interspersed mixture of native plant communities. These communities vary according to elevation, topography, and soil type. In general they may be categorized by cover type. These are broad groupings defined by the predominant vegetation currently occupying a site (e.g. shrub/grass or mixed conifer). Table 3-3 summarizes cover types occurring in the SCNF by acreage.

Table 3-3: Cover Types of the SCNF by Invasive Plant Management Zone

SCNF Cover Types	Lemhi Zone	North Zone	Pahsimeroi-Lost Zone	Salmon Zone	Upper Salmon Zone	Grand Total
Conifers						
Conifer/Fescue	1,184	935	2,446	1,425	6,317	12,307
Douglas-fir	72,018	146,626	175,500	214,526	193,945	802,615
Limber Pine	5,929	0	24,378	0	3,967	34,274
Lodgepole Pine	40,781	88,871	13,483	189,772	128,253	461,160
Ponderosa Pine	0	59,341	0	13,062	528	72,930
Spruce/Fir	19,558	27,342	26,163	34,539	33,124	140,726
Whitebark Pine	16,466	3,558	26,903	10,729	24,092	81,748
TOTAL ACRES	155,936	326,673	268,871	464,054	390,226	1,605,760
Deciduous Trees/Shrubs						
Aspen	2,031	228	5,186	1,527	2,772	11,743
Conifer/Aspen	850	269	5,561	520	952	8,152
Conifer/Cottonwood	121	858	314	824	58	2,174
Cottonwood	89	1,345	387	863	68	2,752
Cottonwood/Conifer	54	69	78	131	23	354
Moist Shrub	228	54	121	273	317	993
Riparian Shrub	1,062	685	2,288	1,187	3,881	9,103
TOTAL ACRES	4,434	3,508	13,935	5,325	8,071	35,272
Grasslands						
Bunchgrass	831	6,144	15,599	5,875	5,211	33,659
Bunchgrass/Fescue	24,013	40,648	50,469	48,017	33,235	196,381
Dry Shrub/Bunchgrass	594	6,811	9,937	4,691	1,081	23,113
Fescue	8,341	1,020	9,869	1,706	7,532	28,467
Fescue/Conifer	5,745	1,043	16,988	3,417	14,581	41,774
Grass/Forb	2,209	11,306	2,064	27,235	10,689	53,503
Sand Dropseed	0	0	290	0	0	290
TOTAL ACRES	41,731	66,971	105,217	90,941	72,329	377,188
Evergreen Shrub						
Black Sage	129	0	12,797	0	1,601	14,527
Conifer/Mtn Big Sage	18,551	2,164	106,225	18,012	40,326	185,278
Low Sage	0	0	11,032	0	1,515	12,546
Mountain Mahogany	67	1,036	21,004	718	1,637	24,462
Mtn Big Sage	40,719	1,579	196,197	42,777	59,532	340,804
Mtn Big Sage/Fescue	2,084	153	22,873	867	1,819	27,797
Shadscale	0	0	554	0	0	554
Threetip Sage	4,854	822	664	2,992	4,992	14,323
Wyoming Big Sage	4,196	1,418	54,384	7,591	18,682	86,271

SCNF Cover Types	Lemhi Zone	North Zone	Pahsimeroi-Lost Zone	Salmon Zone	Upper Salmon Zone	Grand Total
TOTAL ACRES	70,600	7,171	425,729	72,956	130,102	706,560
Other						
Pasture/Agricultural	147	225	1,317	147	282	2,118
Barren	48,604	13,170	238,331	23,751	48,273	372,129
Grass/Sedge	0	0	2,394	0	24	2,418
Unknown	2,671	115	2,919	892	1,099	7,695
Water	321	385	323	553	355	1,937
TOTAL ACRES	51,742	13,896	245,284	25,342	50,033	386,296

Natural disturbance (e.g. fire, drought, high intensity weather events, movements and activities of wildlife species, native insects and disease organisms) is a fundamental element affecting plant communities across the project area. Sometimes the effects of disturbance are highly visible (e.g. large-scale fire) while the effects of other types of disturbance (e.g. drought) can be subtle and take months or even years to manifest. Disturbance also varies in pattern and scale across the forest; it can take the shape of a large wildfire burning in a mosaic pattern across the landscape or occur at the microsite scale in the form of ground squirrels excavating burrow systems. Along with factors such as aspect, elevation or soil type, natural disturbance helps shape plant communities and cover types. The effects of natural disturbance influence attributes of plant communities including species composition, plant density, and structural stage. Natural disturbance also influences a plant community's vulnerability to invasive plant invasion. Fire, in particular, can affect vulnerability, and, weed invasion, in turn can alter natural fire regimes (Dodson, 2004).

Fire plays a large role in shaping the landscape in the SCNF; this is especially true as more than a century of fire suppression and changes in plant communities have altered fire regimes across the western United States (Dodson 2004; Heyerdahl et al. 2006; Power et al. 2006). Table 3-4 displays the acreage that has burned, by zone, across the project area in the past 15 years.

Table 3-4: Invasive Plant Zones and Project Area by Acres Burned in Wildfire since 1998

Weed Zone Name	Total Zone Acres	Acres Burned	Percent of Zone Burned
Lemhi Zone	329,446	13,515	4%
North Zone	418,364	241,453	58%
Pahsimeroi-Lost Zone	1,061,810	14,390	1%
Salmon Zone	658,618	176,145	27%
Upper Salmon Zone	650,802	183,163	28%
Project Area	3,119,040	628,666	20%

In the SCNF, there are 23 known terrestrial state and county listed noxious weed species infesting plant communities within the five invasive plant management zones comprising the project area (Map 1-1). These invasive plant infestations total approximately 49,150 acres. With a project area of 3.1 million acres, this means that 1.6% of project area is known to be infested by legally designated terrestrial noxious weed species. It is important to note that the acre figures shown in Table 3-4 contain duplicate acreage. This happens because Forest Service Natural Resource Information System (NRIS) database protocols require that a site-identified invasive plant infestation may consist of only one species. When more than one invasive plant species occupies a site (e.g.

spotted knapweed and hoary alyssum), then two infestations are recorded in the NRIS database, one for each of the invasive plant species present, resulting in a double count. This means that the acreage of known infestations is an over-estimate.

Of these 23 noxious weed species, only six are found in every invasive plant management zone (Table 1-1). These include Canada thistle, houndstongue, leafy spurge, musk thistle, rush skeletonweed, and spotted knapweed. Of these species, houndstongue, leafy spurge, and rush skeletonweed each occupy a total acreage of less than one thousand acres throughout the entire project area.

The most common noxious weed species in the project area are Canada thistle, hoary alyssum, houndstongue, leafy spurge, musk thistle, and spotted knapweed (Table 1-1).These species account for 97% of the acreage of known noxious weed infestations. Spotted knapweed is the most prevalent noxious weed species across all zones, accounting for almost 80% of all noxious weed acreage.

Approximately two-thirds of noxious weed infestations in the project area are one acre in size or less (USDA Forest Service NRIS database). The cover of noxious weeds in most infestations under management is less than 10 percent.

Since 1.6% of the project area contains infestations of noxious weeds, the project area is dominated by native and desirable plant communities. There are areas within each invasive plant management zone, however, with infestations of non-native, invasive terrestrial plant species that are not listed as noxious by the State of Idaho or Lemhi County. This includes land infested by invasive annual grasses, primarily cheatgrass (*Bromus tectorum*) and other invasive annual forbs (e.g. annual or biennial mustards). The presence of these invaders disrupts plant community dynamics and may contribute to the establishment and spread of other invasive plant species. Therefore, they may be treated in conjunction with management of listed noxious weeds for prevention or rehabilitative purposes.

Many of the factors influencing the introduction, establishment, and spread of invasive plants in the project area are associated with ground disturbing activities. These activities include, but are not limited to fire, mining, recreation, roads and trails, and forest management. These activities will continue to occur within the project area and are outside the scope of this analysis. It is recognized that through ongoing human uses and soil and vegetation disturbance in the SCNF, non-native, invasive plants will continue to be introduced. There is a high potential for establishment and spread of invasive plants.

A majority of invasive plant infestations occur on the North Zone and the Salmon Zone. Roads and trails are a common denominator and the primary conduit for invasive plant establishment and spread. A vast majority (90%) of noxious weed infestations in the SCNF occur within 0.25 miles of a road or trail (SCNF Corporate GIS Data).

Most of these invasive plant infestations were established before the Forest Service established a national weed prevention strategy (USDA Forest Service 2004). The Forest Service has come to realize the threat to natural resources posed by invasive plants and has implemented national policy to address sources of invasive plant establishment and spread, such as invasive plant prevention strategy.

3.2.6. Environmental Consequences

3.2.6.1. Alternative 1-No Action

There are many thousands of acres of native plant communities across the SCNF that are weed-free, but which are vulnerable to the introduction and establishment of invasive plants, such as grassland, shrubland and dry forest (i.e. Douglas-fir and ponderosa pine) cover types. Based on averageannual historical rates of invasive plant spread, it is known that untreated invasive plant infestations have the potential to expand at an average rate of 1.3 to 25 percent a year (Duncan and Clark 2005). These increases result not only from the continued spread of existing plants in an area, but also through distribution to new areas by a variety of vectors, such as wind, water, animals, and humans. Once occupied by invasive plants, these plant communities may not recover to pre-invasion conditions. Forest cover types that are in an early successional stage after a disturbance event are the most vulnerable to invasion (Dodson 2004). The presence of invasive species could have a cascading effect that results in large scale changes to ecosystem structure and function. Plant communities altered by invasion often do not respond to natural disturbances such as fire, insects and pathogens, and natural weather events (e.g. high intensity rain storm) as they once did.

Direct and Indirect Effects

Under the No Action alternative, invasive plant control in the SCNF would cease. There would be no use of biological control, herbicide or mechanical control, and there would be no annual treated or applied acres of invasive plant control in either aquatic or terrestrial settings (aerial or ground-based).

Invasive plants would infest plant communities across the SCNF unimpeded since existing invasive plant populations would no longer be controlled and there would be no detection inventories for new invasive plant species. Existing infestations would expand eventually to the limits of suitable habitat with the abandonment of current containment boundaries. These existing infestations would act as reservoirs to infest new areas. This would include steep, inaccessible, or remote areas as invasive plants would be moved by birds, animals, wind and water.

There would be an increase in the number of spot infestations arising from these existing infestations, contributing to an increased rate of growth. The density of existing infestations would also increase.

New invasive plants could become common and widespread if they were introduced onto lands in the Forest. Eventually, existing and new invasive plant species could colonize and occupy all suitable habitats. The cessation of detection and rapid response efforts could result in the establishment and spread of new invasive plant species and new infestations.

Invasive plants would move along vector routes, such as roads and trails, as spread by human activities and animal movements. Infestations would establish and spread rapidly along the length of roads and trails with the cessation of invasive plant control activities (Ferguson et al. 2003, Gelbard and Belnap 2003). Road and trail corridors would become heavily infested with invasive plants. Vehicles, people, and animals would pick up invasive plant seeds traveling along infested roads and trails and could then introduce seeds into areas that are currently uninfested.

Without control, invasive plants would have a high potential for exponential growth. Spread rates would vary depending on the invasive plant species, size of current infestation, disturbance history, present disturbances and site productivity at each site. For example, a 5-acre sulfur cinquefoil infestation, at a spread rate of 10 percent per year, could occupy 5.5 acres one year later, but would occupy 8 acres within 5 years. The larger the infestation became, the greater the number of acres it would occupy in every subsequent year. With increasing infestation size and density, outcomes such as increased rate of spread and increased spot infestations occurring away from the main body of the infestation result (Frid et al. 2013).

Seed banks of most invasive plant species would build rapidly as many species produce large amounts of seed every year, much of which remains viable for several years to more than a decade (Schulz 2011). Rhizomatous weeds would spread faster than many tap rooted weeds because they spread both via seed and through rhizome expansion (Sakai et al 2001). This dual spread mechanism would allow rhizomatous weeds such as leafy spurge and yellow toadflax to spread more rapidly. Wind-dispersed seeds, such as rush skeletonweed, would spread quickly across broad geographic areas, with many small, separate infestations combining rapidly (Kinter et al. 2007). Over time, a new invasive plant could be introduced, establish and eventually come to co-dominate or replace existing invasive plant species (Sheley and Petroff 1999, Sakai et al. 2001).

Mechanical control would cease under the No Action alternative, leading to an increase in plant density and the outward expansion of invasive plant infestations that are currently controlled mechanically. Invasive plant seeds that are widely distributed by animals or by wind may spread long distances once mechanical control ends.

Biological control agents that have been released in the past and that have formed reproducing, self-sustaining populations would not and cannot be eradicated. Existing populations of biological control agents would probably continue to spread naturally as invasive plant infestations expand. Biological control agents would not slow or halt the spread of invasive plant infestations, but would provide a low level of control, reducing invasive plant density.

However, under the No Action alternative, there would be no new releases of biological control agents. For example, newly available agents that could help provide more effective control of species such as rush skeletonweed would not be released in the SCNF.

Indirectly, as invasive plants spread out into uninfested plant communities, an entire set of cascading plant community changes result (Sheley and Petroff 1999). Native plants become stressed from the additional competition imposed by invasive plants. The percentage of native vegetation occupying a site declines as invasive plant density increases. Eventually, there is a decline in of native plant diversity as more and more native species are eliminated from the community. In some cases, there are changes in fire regime and other natural disturbance processes as invasive plants alter natural successional stages.

In turn, these changes in plant community composition lead to another set of indirect effects at the ecosystem level (Sheley and Petroff 1999). For example, there may be changes in insect populations, such as pollinator populations or those groups of insects eaten by birds and small mammals, changing species' interactions. Leaf litter and organic input to streams and ponds may be altered or reduced. Palatable and nutritious native grasses and forbs are replaced with invasive plant species that do not provide necessary nutrition and which may not be palatable, reducing

wildlife forage values. Some invasive plant species are known to be toxic or an irritant to some kinds of animals (as well as to humans). Changes in the composition and structure of plant communities can lead to changes in arthropod populations, including pollinator populations, and can profoundly affect food webs for all resident and migratory fish and wildlife species. These changes in native plant community composition and structure can have severe impacts on wildlife populations and on livestock carrying capacity by altering forage availability and by reducing cover and habitat (see Fisheries, Range, and Wildlife Specialist reports).

Soil erosion may increase as deep or fibrous-rooted native plants that bind and hold soil are replaced by invasive plant species with shallow roots or those with simple taproots. As vacant niches are left in the root profile, cover may be reduced on the soil surface, organic material is lost from the top of the soil profile and areas of bare soil may increase. The loss of protective vegetative cover and organic matter in the soil leaves it more vulnerable to erosion, especially in the event of high intensity rain storms (Lacey et al. 1989).

Under the No Action alternative, there would be no rehabilitation or restoration actions taken on sites severely degraded by invasive plant invasion. Sites that would benefit from intervention would not receive treatments that enrich the diversity of desired plants on the site, increase the cover representation of desired plant species, reduce the area of bare soil, fill vacant soil niches, and reverse soil erosion. Site recovery would be left entirely to natural causes; however, in the absence of any invasive plant management, it seems unlikely that recovery would take place.

These changes in plant community composition, structure and function could all lead ultimately to reduced ecosystem function and reduced quality of services. These changes could include decreased biodiversity, nutrient cycling, pollination of native plants and desirable non-native food crops, land productivity, soil formation and fertility, erosion control, and water cycling (Charles and Duke 2007). Other tangible ecosystem services include support of businesses engaged in recreation and tourism, such as outfitters and guides. Less tangible, but still vital, services include aesthetic, bequest, cultural heritage, educational, and scientific values.

Cumulative Effects

With invasive plant management discontinued under the No Action alternative, human activities, animal movements across the landscape, and natural events would still contribute to the dissemination of invasive plant seeds and root fragments. Appendix H displays present and foreseeable human uses of resources in the project area that may, in concert with each other and with natural events, contribute to cumulative effects under the No Action alternative.

Past human activities and human uses of natural resources in the project area have introduced and spread invasive plants in the project area, particularly in rangeland, riparian areas and low elevation conifer forest cover types. These existing invasive plant infestations would persist, new infestations would establish and new invaders would arrive; this cannot be changed with the cessation of control activities. There would be no restrictions on human activities and human uses of natural resources in the project area with the intent of preventing continued persistence and spread of existing invasive plant infestations. Under the No Action alternative, these human activities and uses of resources in the project area would, in combination with the existing condition, contribute to cumulative temporal and spatial increases in invasive plants in terms of number, size and density of infestations.

Events such as flooding, fire and drought would continue to create disturbed areas susceptible to invasion. In conjunction with the cessation of invasive plant control, these natural events would have cumulative negative impacts to native vegetation. For example, invasive plants could spread more rapidly in burned areas because post-fire conditions often favor many of the invasive plant species that occur in the SCNF. These characteristics include recent soil disturbance, opening of the overstory canopy, soil damage from heat, removal of competing native vegetation and fire suppression activities by hand crews, equipment and vehicles that could spread existing and introduce new invasive plant weed seed and rhizomes.

Since invasive plant management in the SCNF would be discontinued under the No Action alternative, the SCNF would become a very large and broadly distributed source of invasive plant seeds and root fragments for non-Forest Service System lands in Butte, Custer and Lemhi counties, with spread occurring through human activities, animal movements, water, and wind. As invasive plant seeds were brought in from other places, they would establish new infestations in places such as those with heavy traffic or human use. Then they would begin to spread out along roads, trails and streams from the initial point of origin, with a high likelihood of spreading onto other land ownerships in Butte, Custer, and Lemhi counties.

Private, state, county, and municipal entities would continue to implement active IWM programs. Landowners adjacent to National Forest System lands would likely see an increase in invasive plants spreading onto their lands over time. Cumulatively, if this alternative were to be chosen, the burden of management would shift entirely to other federal, state and local entities. This would include cooperative weed management areas and private landowners. The repeated events of invasive plant introduction and establishment from SCNF system lands to lands in other ownerships in central Idaho, would severely impact the budgets and personnel resources of these other weed management programs. In turn, their efforts could become less successful, resulting in a worsening condition over time.

These other invasive plant management entities would continue to practice invasive plant control, including herbicide applications and biological control. As an example, biological control agents could be released on land adjacent to or near SCNF system lands. There would be potential for natural movement and establishment of these agents into the SCNF, even if the SCNF no longer practiced invasive plant management. However, there would be no deliberate redistribution of agents by the SCNF and no cooperative efforts with other land managers to coordinate the use of biological control methods.

Long-term control has been practiced on many invasive plant infestations in the SCNF with the goal of eradicating the seed bank and restoring native plant communities. These areas are usually re-inventoried every few years and scattered individual plants and small patches are eradicated as soon as they are found. Over time, the density of invasive plants and annual seed production has declined greatly and native plant communities are thriving in places that were formerly infested. Once invasive plants inventory and control ends, the long-term investments made over the years would be lost. The remaining viable seeds in the seed bank would sprout and reproduce, re-establishing infestations. This effect would be exacerbated by present and foreseeable human activities and resource uses in the project area (Appendix H), were invasive plant management to be discontinued. Wildlife movements and natural events, such as drought or wildfire, would also contribute to should these past investments in invasive plant control be lost.

Future control costs would be increased if the SCNF elected to re-initiate an invasive plant management program at a later date. The likelihood of successfully re-establishing and IWM program for the SCNF would be substantially reduced after a hiatus. The chance of effective control would be diminished as infestations grow larger and denser. Past and current investments in control and restoration would be lost as invasive plants re-occupied sites that have been restored to healthy desired plant communities.

No Action Summary

The No Action alternative does not contribute to attainment of the desired condition for plant communities in the project area. Nor does it comply with federal legal requirements or with Forest Service national and regional direction on the management of invasive plants species.

Ending all invasive plant management practices in the SCNF could result in an unchecked expansion of invasive plants until all habitats were occupied. The spread of invasive plants would lead to a cascading set of ecosystem impacts. These would include, but are not limited to, deleterious effects such as loss of watershed function and ecosystem services, reduced soil stability and water holding capacity, loss of wildlife habitats, or alteration of trophic webs.

If, at a later time, the SCNF chose to re-establish invasive plant management, many more acres of habitat would have been infested and new invasive plant species would likely have established, making invasive plant control more difficult and expensive.

3.2.6.2. Information Common to All Action Alternatives

Each of the action alternatives explored by the SNCF includes an integrated weed management (IWM) approach to invasive plant management. Under the action alternatives, IWM incorporates the use of biological, chemical, and mechanical treatment options. These options are implemented singly or in combination with each other to manage the invasive plants. Table 2-9 displays the range of effective treatment options for each of the noxious weed species that presently infest SCNF system land.

Some measures taken in an Integrated Weed Management (IWM) approach may cause damage, including mortality, to non-target plant species. It is important to note that invasive plant treatments (1) prevent the decline of native species diversity, (2) protect fish and wildlife habitat and (3) help maintain watershed and ecosystem functions, all of which would suffer substantial loss as a result of uncontrolled invasive plant species establishment and spread (Dewey et al. 1995). The SCNF considers the impact of these losses when determining invasive plant management objectives, priorities, and treatment options. Successful invasive plant management meets legal requirements, national and regional standards, and contributes to achieving the desired condition for plant communities in the SCNF.

Not all inventoried invasive plant infestations receive treatment annually due to budget and personnel constraints. Retreatment is often necessary to maintain the control level of initial treatment depending on the invasive plant species, size and density of an infestation, seed bank viability and site condition. Thus, multiple treatments may be necessary to achieve control objectives.

Impacts to desired plant communities are reduced when control actions are taken at an early stage of invasion. Effects on plant communities increase as invasive plant infestations expand in size and plant density. The increased impacts come not just from the invasive plants, but also from the control measures. When treatments must be broadcast across a larger area and not specifically focused on the target plant, control measures have greater potential for impacts to non-target plant species. This is particularly true for herbicide treatments. Invasive plant management is an ongoing commitment and investment by the SCNF.

Direct and Indirect Effects

Biological Control

There are many reasons why invasive plants are able to overwhelm native plant communities and establish themselves as the dominant plant species, even on undisturbed sites in excellent condition. One reason is that most invasive plant species arrived in the US, often as seeds, without the array of natural enemies that keep their populations in check in their native ranges (Westbrooks 1998). These natural enemies include insect pests, fungi, parasitic organisms, and pathogens as well as birds and mammals that consume plant material. Native plants are often competitively disadvantaged compared to invasive plants because the native plants do have to contend with natural enemies and foraging animals. The goal of biological control is to reconnect the link between invasive plants and their natural enemies.

Classical biological control is the introduction of host-specific plant pests and pathogens from their native ranges into new areas across the world where they can be used to control invasive plants (Harris et al. 1991). There are many factors that influence the success of biological control agents that target invasive plants (Morin et al. 2009, Van Driesche et al. 2010). While some biological agents can fly and readily spread to other invasive plant infestations, others have to crawl from host plant to host plant, which slows their rate of spread. Habitat conditions must be right to establish and reproduce and some agents cannot survive the annual variations in our climatic regime. Others are difficult to obtain and are expensive to rear or purchase. Some reproduce, and therefore spread, more slowly and supplemental releases may be required. The impacts of biological control also appears to be cyclic, meaning that invasive plant populations can vary as the populations of biological control agents wax and wane in response to invasive plant populations, site conditions and other factors.

As a result, biological control is a slow, long-term process that is often less successful than other forms of invasive plant control, especially where it is the sole form of management. Biological treatment is typically implemented when other treatment methods are not an option. These include (a) large, dense infestations of well-established invasive plants, such as spotted knapweed in areas of past timber harvest in the North Zone, (b) isolated locations where personnel access is limited and cost prohibitive, and (c) areas where topography or other site conditions pose a safety concern for invasive plant management personnel.

In some cases, biological control does not provide a long-term solution to invasive plant control objectives. Biological control agents may not be well-adapted to an area and have difficulty becoming established, reproducing, and spreading. The negative impacts to the target plant may be insufficient to have an impact on the larger target plant populations because the biological agents may be unable to substantially reduce seed production or only slightly reduce plant vigor. As a result

the target plants can maintain root reserves and are able to recover from the effects of the biological agent. For example, five different spotted knapweed biological agents have been released in the SCNF since the 1980s and have had little discernible effect to the density and vigor of spotted knapweed infestations even where there is discernible damage to individual plants. In recent years, a more promising biological control agent for spotted knapweed, a root weevil (*Cyphocleonus achates*), has been introduced. This agent has proven able to successfully establish, overwinter, and spread independently (albeit very slowly) within the project area. However, substantial reductions to spotted knapweed populations have not yet been observed except for a few, localized settings. Ongoing field observations elsewhere indicate that it may take 10 to 20 years for this agent to begin to effectively reduce plant density, vigor and seed production in spotted knapweed infestations (Randall 2014). Additionally, one biological agent used to manage musk thistle, the thistle crown weevil (*Trichosirocalus horridus*), has been shown to be successful in reducing musk thistle's establishment and spread, both within Idaho and elsewhere (Coombs et al. 2004). As part of an IWM program, biological control agents can help reduce plant density and vigor. For example, the SCNF uses biological control agents to supplement herbicide control in larger infestations where treatment cannot be accomplished regularly due to the cost of treatment. Treatment efficacy cannot usually be determined at a release site for at least 3 to 5 years; often it may take many more years for agents to establish, spread and build to sufficient population densities to show impacts to the target invasive plant infestations.

Biological control agents may not be capable of meeting the management objective for an invasive plant species within a particular management zone. Some studies estimate that only 40% of biological control agents provide substantial control (Thomas and Willis 1998). Biological control agents do not always reduce host plant vigor and rate of spread substantially, so invasive plant infestations may increase in density and area faster than biological control agent populations. In cases such as these, other control methods, such as herbicide application or mechanical control, are often used in conjunction with biological control agents.

Herbicide Control

Herbicides are usually classified based on their chemical structure or mode of action and are taken up by plant roots or through foliage and transported within the plant through the vascular system. Herbicides kill or stress plants by inhibiting enzymes involved in photosynthesis, respiration, and other physiological processes (Bussan and Dyer 1999).

Herbicide application utilized properly is an important tool in managing invasive plants. Management of invasive plants, that allows desired vegetation to recover from invasive plant infestation and re-establish strongly following herbicide treatment, can be accomplished by applying the appropriate herbicides at an appropriate rate and by using appropriate application techniques that minimize affects to desirable species. The use of design criteria (Appendix J) and application techniques contribute to successful herbicide management by minimizing impacts to desirable plant communities.

The intention of an herbicide application is to eradicate or suppress infestations of invasive plants through direct mortality, decreased plant density, reduced competitiveness, and cessation of seed production or root system expansion (Bussan and Dyer 1999). The intended result is expressed in an increase in desirable plant abundance and vigor, creating more invasive plant-resistant plant communities.

Although herbicides have the potential to affect both invasive plants and desirable plants, there are differences in susceptibility to herbicides among plant species and families (Rice and Toney 1998). Some plants metabolize herbicides, which reduces toxic effects. Some species do not readily absorb herbicides through foliage and roots. For herbicides to be effective, they must be taken into the plant and impair physiological processes (Bussan and Dyer 1999).

Plant species that have similar growth forms and genetic composition often are similarly affected by herbicides; consequently, herbicides have the potential to adversely affect invasive plants and desirable plants that have similar growth forms, genetic makeup, and life history characteristics (Rice and Toney 1998). Appendix I displays non-target vegetation groups and their relative susceptibility to herbicide treatment. In general, most herbicides currently being used in the SCNF (with the exception of glyphosate) have a higher potential to affect broad-leaf plants than graminoids (grasses and sedges) (Rice and Toney 1998, Bussan and Dyer 1999). Therefore, desirable broad-leaf species have a higher potential to be adversely affected by herbicide application than desirable graminoids.

A particular herbicide is chosen based on the target invasive plant species, presence of desirable non-target vegetation, proximity to water, and distribution of desirable species. Site factors and season of use are also considerations. Clopyralid is an example of one of the most selective herbicides currently in use in the SCNF while glyphosate is a nonselective herbicide that will kill most plant species, including graminoids.

In addition to herbicide selection, technique is also an important decision. The two primary types of herbicide application used in the SCNF are spot treatment and broadcast application. Spot treatment is performed by spraying individual plants and the area directly adjacent to them, avoiding the application to non-target plants as much as possible. In the SCNF, most herbicide application is made as spot treatments.

Broadcast application is only chosen when the number of spot applications necessary to treat an infestation is so large as to make it impractical or where the areas adjacent to the invasive plants overlap. Managers make the decision to spot treat or broadcast spray based primarily on the size and density of the invasive plant population, terrain, and proximity to water. The size of infestations (larger) and the density of invasive plant cover (higher) sometimes result in a need for broadcast applications. Also, on flatter terrain, mechanized equipment may be preferred for broadcast applications due to cost considerations. In order to keep non-target impacts to a minimum, it is important to maintain application equipment properly functional and calibrated, selecting herbicides less likely to cause damage and using the lowest effective application rate.

Spray units may be mounted on vehicles such as trucks or utility vehicles (UTVs). A vehicle-mounted sprayer is not synonymous with broadcast application since these units are set up to perform spot or broadcast applications. In the SCNF, personnel perform very little broadcast application. First, most infestations in the project area are small (less than one acre in size) and do not yet consist of monocultures of invasive plants. The invasive plant cover in infestations that are managed for eradication or control is typically very low, often amounting to only about 10 percent of the vegetation within the infestation. The areas where there are large infestations are typically not accessible by ground-based equipment and are not being treated. Secondly, spot applications are preferred wherever possible to reduce impacts to non-target plant species to the extent possible. Mechanized equipment is not suitable for finely tuned spot applications, although some target

selectivity can be achieved by turning nozzles off and on as needed when invasive plant distribution is patchy. Almost all vehicle-mounted broadcast applications are made along year-round open roads that receive heavy recreational traffic. This level of traffic greatly increases the number of infestations that establish, necessitating annual invasive plant control. Crews using vehicle-mounted sprayers apply herbicide only where invasive plants are found, creating stretches of broadcast application interspersed with stretches where no herbicide is applied because no invasive plants were found. Examples of spot and ground based herbicide application scenarios are discussed in Appendix M.

Native forbs are important components of many plant communities (Pokorny et al. 2004) and most native forbs serve as pollinator plants for a variety of insect pollinators. Native forbs are the best for native insect pollinators, such as bees or butterflies, for several reasons. Native forbs and their pollinators are (a) well-adapted to one another, with native forbs providing habitat across the landscape at the right time of the year for various populations of pollinators, (b) native forbs provide not only forage in the form of nectar and pollen, but also habitat for resting, mating or laying eggs and (c) native plants are adapted to local growing conditions (Washington State Noxious Weed Control undated).

Processes such as weed invasion and weed control disrupt plant community composition, structure and function (Pearson and Ortega 2009). Although some invasive plants, such as spotted knapweed, can provide forage for native pollinators, their overall impacts on an ecosystem far outweigh possible benefits (Washington State Noxious Weed Control undated). In some cases, insect pollinators are even known to contribute to the spread of non-native invasive plants by increasing the number of pollinated flowers and, therefore, seed production (Barthell et al. 2001).

Likewise, weed control can also impact non-target forbs. Herbicide application, in particular, has the potential to affect pollinator plants, for example, favoring graminoids over forb species (Crone et al. 2009). SCNF weed program managers have multiple options to reduce the impact of herbicide application on native pollinator plants, including herbicide selection, application technique, lowest effective use rate, season of herbicide application, and making spot applications wherever possible. Researchers note specifically that making spot applications everywhere possible helps to reduce this impact (Pokorny et al. 2004, Crone et al. 2009, Pearson and Ortega 2009, Ortega and Pearson 2011). SCNF weed program managers use spot herbicide applications as the preferred method wherever possible.

In addition, in the project area, the effects of herbicide application are moderated by the scale at which invasion and herbicide application occurs. Less than two percent of the project area is infested by noxious weeds and, in general, native plants are still present in invaded areas (USDA Forest Service SCNF NRIS database 2012). A majority of areas treated with herbicide application are small; at less than one acre in size (USDA Forest Service SCNF NRIS database 2012). The persistence of even low densities of native forb species and seed banks furnish the components to restore pollinator plants species and their pollinators, even in invaded areas. Herbicide application would result in short-term impacts to pollinator plants, but could yield long-term benefits when implemented as part of an IWM strategy.

In addition to plant mortality, there are several other considerations associated with herbicide application, including spray drift, herbicide movement in soil and water, and spray adjuvants. Herbicide label direction and design criteria (Appendix J) address these considerations. Spray drift

is easily managed (see Direct/Indirect Effects of Herbicide in the Current Action alternative and the Aerial Application section of the Proposed Action) and there are a number of design criteria (such as maximum allowable wind speed) that address the management of spray drift.

The possibility of herbicide movement in soil depends on a number of factors, including properties of the herbicide selected for use, site-specific conditions (such as topography, soil type, and depth to the water table) and the climatic regime. Motility varies among herbicides; some are highly mobile in soil while others are not (SERA 2011 a-d, 2010, 2007 a-b, 2004 a-f). Picloram, for example, can be highly mobile in soil depending on site conditions while glyphosate is not mobile. Herbicide is more likely to move in soil on steep slopes and on porous soils, especially soils with little organic matter. Areas with high annual precipitation are usually more prone to the risk of movement than arid climates, as are areas that experience high intensity rainstorms.

There are two primary concerns with the movement of herbicide through soil or water away from the application site. The application cannot perform as intended if the herbicide moves downward in the soil profile below the target invasive plant root zone. Likewise, leaching through the soil could affect non-target vegetation off site while not accomplishing the purpose of the application.

The other concern is that herbicide could unintentionally be moved into water, whether through water flow that washes herbicide away (such as a high intensity rainstorm) or should herbicide move into the water table or a water body. Herbicide that enters water unintentionally at high enough concentrations could potentially harm aquatic organisms, such as aquatic vegetation, invertebrates or fish. While this scenario is unlikely with the type of herbicide applications made in the SCNF, managers are aware of the possibility of herbicide movement off site and consult herbicide labels with the objective of avoiding movement when making decisions on herbicide selection and use rates.

Herbicides are registered by the EPA and every herbicide, as required by federal law, has a label that provides EPA and manufacturer guidance and instructions on safe and proper use of the herbicide. Federal law requires compliance with an herbicide label. Adherence to label guidance and instructions are identified as design criteria (Appendix J). Instructions on herbicide labels provide measures to minimize the likelihood of herbicide movement in soil, such as specifications on how close to water an herbicide may be applied. For example, the label for clopyralid notifies the applicator that “clopyralid is a chemical that can travel (seep or leach) through soil”. The label instructs the user not to apply clopyralid directly to water, to areas where surface water is present or to intertidal areas below the mean high water mark. The label also advises applicators not to apply this herbicide to soils with rapid permeability. The Fisheries and Soil and Water reports further discuss the effects of herbicide soil and water motility to these resources.

The term ‘spray adjuvant’ is a catchall phrase for substances added to an herbicide or spray mix to aid mixing and applying or to improve the efficacy of an herbicide application (Tu et al. 2001). These commonly include adjuvants such as water conditioning agents to buffer hard water, surface active agents (surfactants) to reduce the surface tension of water drops so spray solution spreads out on plant surfaces and does not run off or indicator dye to show sprayed areas so applicators do not over apply or miss patches of invasive plants. Adjuvants may be added to the herbicide formulation at the manufacturing facility or added when applicators are mixing spray at the application site. To be effective, some herbicides, such as imazapic, require the addition of a surfactant like vegetable or

seed oil. Other herbicides, especially when applied to young plants, may need no surfactants. Herbicide labels advise or instruct applicators on the selection and use rates of adjuvants.

Since adjuvants do not contain active ingredients that cause plant mortality, these substances are not subject to same federal laws that govern herbicides. However, this does not mean that all adjuvants are without potential to cause harm to non-target vegetation. Some, such as indicator dye, do not pose a risk of harm to plants while others, such as some surfactants, are capable of inflicting plant injury. As an example, some surfactants contain acidifying agents. These agents can be useful in damaging the epidermal surface of plants, allowing an herbicide to more easily penetrate the leaf surface of target plants. However, the acidifying agent can have the same effect on the leaves of non-target plants and increase the potential for injury or mortality to non-target plants. SCNF managers routinely consult herbicide label direction when making decision about adjuvant use to select the proper adjuvant for a particular herbicide and to select the lowest effective use rate to reduce non-target plant damage. Appendix D displays the type of adjuvants used by the SCNF.

Mechanical Control

Mechanical Control methods include hand pulling, grubbing, hoeing, cutting and mowing, burning, and torching. The SCNF does not currently use or propose to use mechanical methods such as chaining and disking as a method to control invasive plants.

Various methods of mechanical control have been shown to be quite effective in controlling or partially controlling some invasive plant species (Sheley 1994). Mechanical control methods are generally more effective in controlling tap-rooted species or those with shallow root systems. Mechanical control is seldom an effective means of controlling species with rhizomatous or stoloniferous root systems or those that can sprout from deep underground roots.

Mechanical control methods are very expensive and labor-intensive (Duncan et al. 2005, Beck 2013) and are generally implemented in the SCNF only under these circumstances: (a) on small, high priority sites, such as campgrounds or picnic areas, where reducing the threat of spread justifies the expense, (b) on invasive plant species prioritized for high levels of control, such as new invaders identified for early detection efforts, (c) only during seed production stages of plant growth, or (d) in conjunction with other control methods. For example, mechanical removal of seed heads is commonly practiced on small infestations of houndstongue from mid-summer through fall when viable seeds are present on mature plants.

Mechanical control is expensive for two reasons: (1) treatments are physically very demanding and time-consuming, so daily output is very low; hard rocky soils and high invasive plant densities further slow the work, and (2) treatments must be repeated frequently to be effective, sometimes as often as every two to three weeks, depending on the target species. This means that while mechanical control can be effective at a very small scale, it is not effective at the landscape level.

Mechanical control as the sole method of eradicating an invasive plant infestation is often ineffective because of the long-term viability of invasive plant seeds in the soil. Mechanical treatments are also often less effective than herbicide applications. There is only a narrow seasonal window for implementation. Pulling, grubbing, and hoeing are usually effective only in the spring and early summer when the soil is moist enough to effectively remove the entire root crown or root

masses of target plants. Pulling leaves and stems but not removing the root crown does not kill the plant and usually results in prompt regrowth.

Additionally, once plants have dropped seed for the year, mechanical treatment can become ineffectual because seeds remaining in the soil which ensures a fresh crop of invasive plants the following year. Most invasive plant species are prolific seed producers and have the ability to regenerate and produce seed following removal of top growth, so mechanical methods can prompt rebloom.

Mechanical treatments can kill many, but not all, tap-rooted species (some invaders, such as rush skeletonweed, are able to resprout from segments of taproot left in the ground). Mechanical treatments of rhizomatous or stoloniferous (such as leafy spurge or invasive hawkweeds) do not kill plants, but reduce seed production only for the season they in which they are treated.

Removal of seed heads can improve treatment efficacy by reducing the potential for viable seeds to be spread by people, domestic livestock, or wildlife. Very small infestations are often pulled or grubbed to remove viable seeds on existing plants and then treated with herbicide. However, if the infestation consists of many mature plants in seed set, mechanical removal is too time-consuming and expensive to be a practical control method. For that reason, mechanical control methods are often combined with herbicide applications, especially for Dalmatian toadflax, houndstongue, leafy spurge, rush skeletonweed, and salt cedar. Once herbicide application has reduced the size and density of the infestation, integration of mechanical control helps to reduce the risk of further spread. Mechanical treatments are also effective when combined with reseeding or other restoration efforts.

Rehabilitation and Restoration Practices

Forest Service manual and handbook direction provides guidance on rehabilitation and restoration. “Rehabilitation” is defined as repairing ecosystem processes, productivity and services while “restoration” is defined as more actively assisting the recovery of an ecosystem that has been degraded to the point it no longer has biotic integrity in terms of species composition and community structure (FSM 2070 2008). Rehabilitation may require little more than invasive plant control measures and removal of disturbance (e.g. foot or vehicle traffic) for a time to allow a site to recover naturally on its own. Some sites that have been highly degraded by invasive plants may require more intervention in addition to invasive plant control, such as seedbed preparation, seeding, planting plugs, or mulching.

Invasive plant control is a rehabilitative and restorative practice in itself, aimed at reducing or removing invasive plants and the bank of viable seeds stored in the soil to promote the establishment and maintenance of desirable plant species (USDA FS 2011a). An upward vegetative trend of desired plant species helps meet the desired condition of plant communities in the SCNF. Healthy, functional plant communities containing desirable species are resilient to disturbance such as fire and are more resistant to invasive plant invasion.

Some degraded sites require additional intervention to achieve a desired plant community that is stable, self-sustaining, resilient to disturbances and resistant to weed invasion (Masters and Sheley 2001). Sites may be so impacted by invasive plants that rapid recovery of desired plant species is limited by one or more factors (Goodwin et al. 2006). There may not be enough native seed left in the soil. The soil may have been affected by allelopathic compounds from the invasive plants. There

may have been changes in pollinator population levels or species diversity. In these cases, when desirable plant species, whether native graminoids and forbs or a mix of non-native plants suited to the site (e.g. a pasture grass mix at an administrative site) are no longer present on the site, then revegetation must be considered. From a natural resource management perspective, post-treatment plant communities are considerable more desirable than untreated invasive plant-dominated communities.

For recovery to proceed, whether natural recovery or human-assisted restoration invasive plants must be controlled (Kardol and Wardle 2010), sources of disturbance and vector pathways need to be managed, and microsite niches must be available to receive and shelter desirable vegetation, whether seeds, plugs or transplants (Goodwin et al. 2006, Sheley and Half 2006, Brown et al. 2008).

The Forest Service prefers to rely on natural regeneration as part of rehabilitative measures to restore ecosystem structure, function and productivity on sites degraded by invasive plants. Passive or natural regeneration is preferred during and after control treatments for sites that still contain sufficient cover and density of desirable plant species. There are a number of advantages to natural site recovery. Sufficient native or desirable vegetation or seed sources may still be available on site or nearby, making assisted recovery unnecessary. Where some or many components of a native plant community are still present, unassisted natural recovery may readily occur, although some vegetation groups may take longer to recover than others (Goodwin et al. 2006). In addition, a few researchers have suggested that relict vegetation on a heavily invaded site may possess some adaptions to cope with the invading plant species (Callaway and Ridenour 2004, Mealor and Hild 2006, 2007, and Leger 2008). If so, allowing this relict vegetation to re-establish could confer some degree of resistance to re-invasion.

Typically, site restoration involves supporting the re-establishment or return of desirable vegetation to a degraded site because necessary components of the plant community are no longer present or are too few in number. When assisted restoration must be used, native species are preferred in most situations. If possible (where and when available), locally sourced seed or plants are also preferred. When locally sourced plant materials are not available, the Forest Service uses seed and plants produced commercially from nurseries whose parent stock comes from locations on which site conditions are similar to the area requiring restoration.

Assisted restoration is used at very high priority sites (e.g. where no native seed sources are available or in areas with high human uses). Often, the best assistance is simply to reduce human disturbance and allow an area time to slowly recover. As an example, fencing to prevent human or animal access is often a very useful strategy, but it is not effective over large areas.

Natural regeneration may be slower, but it is the more desirable outcome. However, there are also drawbacks to natural regeneration. Natural regeneration reduces the risk of introducing a new invasive plant, however, it could occur so slowly that invasive plants could re-establish in the area before desirable vegetation, negating the benefits of control. Natural regeneration may not compete well against invasive plants. For example, most invasive plant species have persistent seed banks that can make it harder for desirable plants to re-establish. Following treatment of a monoculture or near-monoculture of invasive plants, desirable species may have to be seeded to re-establish desirable native or non-native vegetation and prevent re-invasion. As another example, areas with active soil erosion may recover too slowly to protect the soil, resulting in yet more soil erosion and increased site instability.

Site environmental properties are important to consider when developing an implementation plan for assisted restoration (Goodwin et al. 2006). Topographical features, such as elevation, aspect and slope, need to be assessed as do soil attributes and local climatic conditions.

Soil-related factors such as compacted or shallow topsoil, poor soil fertility, lack of soil micro-organisms or insufficient microsites to harbor seeds can strongly influence the outcome of assisted restoration actions (Goodwin et al. 2006).

Weather also plays a large role in the success or failure of assisted restoration actions. Lack of adequate moisture when seeds are germinating and developing root systems may yield poor establishment or complete failure to establish (Goodwin et al. 2006). Conversely, too much precipitation can wash soil away from germinating plants before their root systems develop sufficiently to hold soil in place. The two most common reasons a restoration activity fails are lack of moisture during the seedling phase and intense competition with non-native invasive plants for growing spaces and site resources (Sheley and Petroff 1999).

Although natural regeneration is usually considered as the best method, if invasive plant invasion and site disturbance has caused local extinctions of native or desirable plant species, leaving behind few, if any, relict plants and no seed bank is present, then assisted recovery becomes necessary. The decision to implement rehabilitation or restoration includes factors such as low native species diversity, low plant cover, lack of seed sources from nearby areas, the need to establish desirable vegetation to compete with invasive species, and stabilizing eroding soil. When desirable plant cover or density is too low for a site to recover on its own in a timely manner, then assistance in the form of interseeding may be needed to achieve management objectives for the site. When assisted recovery actions are determined to be the best choice, the Forest Service has established practices to guide managers in site recovery. Based on the cost of implementation and site limitations, such as access or topography, weed managers may have to rely on natural regeneration at some sites because they cannot effectively regenerate the sites otherwise.

Monitoring and Treatment Effectiveness

Monitoring is a necessary part of implementing an adaptive IWM program. Monitoring addresses Early Detection and Rapid Response (EDRR), treatment, and restoration efforts, and informs future decision-making and strategy. Information collected from monitoring may be used by managers to evaluate the efficacy of invasive plant detection and control and rehabilitation and restoration actions. There are two basic types of monitoring essential to an adaptive IWM program: implementation monitoring and effectiveness monitoring. Implementation monitoring answers the question, “Did we do what we said we would do?” and effectiveness monitoring answers the questions, “Were treatment and restoration actions effective?” and “Were intended goals accomplished?”

Monitoring treatment efficacy is an important part of a comprehensive invasive plant management program. Monitoring treatment efficacy helps to validate treatment priorities, adapt future treatment techniques to meet project needs, and determine the effect of treatments on non-target organisms. Monitoring treatment activities also allows program managers to identify changes in the extent, distribution and density of invasive species populations, non-target organisms and other biotic and abiotic factors in the affected ecosystem.

Monitoring informs managers of the effectiveness of invasive plant control measures. Treatment effectiveness can be considered at two scales. The first is at the scale of the actual infested site, where factors such as the invasive plant species present, the size and density of the infestation, the size and persistence of the seed bank, and site characteristics, such as accessibility or special restrictions, determine which treatment methods are practicable, and the amount of time and money needed to meet the site objective. Having a choice of treatment methods at a site increases the ability to match the treatment to the site conditions and improves effectiveness. Per Forest Service protocol (at least 50% of all invasive plant control treatments must be monitored annually), invasive plant control treatments are routinely monitored for efficacy. For example, data for herbicide applications in general illustrates a 90% aggregate control rate for all noxious weed species (Forest Activity Tracing System (FACTS) Database).

Effectiveness Monitoring

At the landscape or project area scale (Map 1-1), treatment effectiveness is the relative ability to meet the purpose and need of the project and overall invasive plant management objectives. At this level, consideration of factors such as the ability to respond rapidly to new infestations; potential to coordinate with other landowners and treat across ownership boundaries; flexibility to package treatments and coordinate treatments with other projects and programs; ability to respond to changing conditions and opportunities; and cost are important in evaluating effectiveness.

Invasive plant control often requires repeat treatments and repeated monitoring of control efficacy. As monitoring identifies the effectiveness of treatments, specific control measures are adjusted. Managers may use monitoring data from one site or set of sites to predict the effects of similar actions on other parts of the project area. This information can be used to promote the use of the most effective techniques for detection, treatment and restoration and to avoid the use of ineffective methods. For example, field observations of control associated with SCNF stock pastures show that yellow toadflax is best controlled by fall herbicide applications as opposed to spring applications.

Changes in distribution, target species productivity, cover of an infestation, as well as changes in the infestation size (extent) can be important characteristics used to measure treatment efficacy. The objective is to evaluate performance by measuring the changes in the characteristics of the infestation as a result of treatment activities. It is a Forest Service Business Rule that post-treatment evaluation be conducted for 50% of the acres treated in projects involving herbicides (NFS Invasive Species Management Record-Keeping Business Rules and National Standards 2014).

Implementation monitoring and effectiveness monitoring including, field observations, and photo points are used to develop reports which summarize annual management activities. These various types of monitoring help the SCNF assess progress with invasive plant management and comply with Forest Service direction.

3.2.6.3. Alternative 2-Current Action

Biological Control

Biological control agents have been released extensively in the SCNF. In the past 20 years, the SCNF has made 745 releases of 16 different biological control agents (Appendix K) on six noxious weed

species. The greatest number of agents has been released for treatment of infestations of leafy spurge (7 agents) and knapweed (6 agents).

The current use of biological treatments is limited to the use of classical biological control techniques. The SCNF also uses biological control agents to supplement herbicide control in larger infestations where treatment cannot be accomplished regularly due to the cost of treatment. Table 3-5 displays the three-year average number of annual biological control releases in the SCNF (USDA Forest Service SCNF NRIS 2012, Nez Perce Bio-Control Data Center 2012).

Table 3-5: Acres of 3-Year Average Annual Biological Control by Invasive Plant Management Zone

IPM Zone	2010	2011	2012	3 Year Average
Lemhi	0	2	1	1
North	44	59	27	43
Pahsimeroi - Lost	4	0	19	8
Salmon	6	1	31	13
Upper Salmon	2	1	21	8
Totals	56	63	99	73

The SCNF biological control treatment data for the years 2010 through 2012 identify 218 biological control releases within the project area. The majority of those releases (137) had spotted knapweed as the target species. Releases targeting leafy spurge were the next most common at 53 releases. There were 21 releases which targeted Canada thistle and the remaining 7 releases targeted the yellow and Dalmatian toadflax. *Cyphocleonus achates*, a root boring/gall weevil for spotted knapweed, and *Aphthona nigriscutis*, a root/defoliating flea beetle for leafy spurge, are the most common agents released within the project area. At least seven different biological control agents were released during this period; often multiple agents were introduced to a site during a single release. As an example of this, *A. lacertosa*, another root/defoliating flea beetle in the same family, is often released in conjunction with *A. nigriscutis*. Both species are documented as having the potential to provide excellent control on leafy spurge seed production and/or plant density (Andreas et al. 2013).

There is no upper limit on the number of biological control agent releases that may occur annually. However, annual monitoring suggests that increasing the number of releases of existing agents would be of little benefit (FACTS Database). The results of monitoring biological control agent releases in the SCNF show that the impacts of most agents released have been variable with sporadic success. Some agents have noticeably affected the target species, such as thistle seed head weevil on musk thistle. Others have had little to no apparent effect in reducing plant vigor, seed production, plant density, or any of the other factors associated with successful biological control. Many of these agents have been released ten or more years ago, so the agents have had sufficient time to adapt to local conditions and build population levels high enough to impact target invasive plants. Even those agents that are common and widespread throughout the range of the target species display effects insufficient to provide desirable control levels. Although biological control itself has not produce desired control levels, it is an important component to an integrated weed management approach and can increase control efficacy in conjunction with other treatment methods.

Herbicide Control

Herbicide application is an important invasive plant control strategy and the SCNF currently uses ten herbicides as part of its IWM program. A three-year average of acreage treated by herbicide from 2010 through 2012 shows approximately 6,000 treat acres and 1,200 applied acres (Table 2-1 and Table 2-3).

Table 2-2 displays herbicides currently used in the SCNF by active ingredient, maximum and typical application rates, and application setting. Active ingredient is that portion of a formulated herbicide that causes plant injury or mortality. By law, the active ingredient must be identified on a product's label and the percentage by weight disclosed.

Other components of an herbicide typically include the carrier (usually water) and other ingredients such as colorants and odorants (these assist with health and human safety) and adjuvants, which assist with herbicide performance, such as surfactants to reduce the cohesive tension of water droplets or drift control agents (Tu et al. 2001). These are known as "inert" ingredients because they are not phytotoxic. It is not required by law to disclose the name or percentage of the ingredients on the label or Material Safety and Data Sheet, because the identity is considered proprietary information of the manufacturer. The EPA reviews the inert ingredients to be added to a formulated herbicide prior to registration. The lack of disclosure on the label of other ingredients in a formulation indicates that none of the inert ingredients present at a concentration of 0.1% or greater are classified as hazardous or toxic. The inclusion of certain ingredients in adjuvant formulations is regulated by the EPA, but the testing, the oversight of manufacture, and the use of adjuvants is not regulated consistently.

During the preparation of the Forest Service risk assessments, data on inert ingredients was reviewed, with the exception of 2,4-D (USDA Forest Service 2006). The herbicide formulations for which proprietary information was released to the Forest Service for preparation of the risk assessments show that inert ingredients in herbicide formulations used by the Forest Service are on three of five lists maintained by the EPA. EPA Inert List 4A contains minimal risk inert ingredients (low toxicity or non-toxic) while List 4B contains inert ingredients for which the EPA has sufficient information to reasonably conclude that the current use will not adversely affect public health. EPA List 3 contains inert ingredients for which available toxicology data are insufficient to classify the compound as of toxicological concern (List 1), possible toxicological concern (List 2), or of minimal concern (List 4) (US EPA 2012b). No toxic substances were identified as being included in herbicide formulations used by the Forest Service .

Herbicide Summaries

This section provides a summary of each of the herbicides presently in use by the SCNF. The primary reference for information on each herbicide is the Forest Service risk assessment for the active ingredient being analyzed and specimen labels.

Most of the herbicides used by the SCNF are selective, translocated herbicides, some of which remain active in the soil after application, providing an additional period of invasive plant control after the initial application. Selective herbicides kill some plant species while other plant species may be unharmed. The primary difference between susceptibility to an herbicide and tolerance is metabolic. Tolerant plants resist the herbicide by not absorbing it or by metabolizing the herbicide into natural, non-harmful components. Translocated herbicides move from plant foliage (or in the

case of herbicides with soil residual capability, from the soil) into areas of active plant growth in root and leaf tissue. It is here in the growing points of a plant that active ingredients exert their effect.

See Appendix I for a specific description of the common injuries to non-target vegetation groups associated with each of these herbicides described below.

2, 4-D

2,4-D is regularly used in the SCNF primarily in riparian areas since under the Current Action, only 2,4-D and glyphosate may be used within 15 feet of water. The average annual output of 2,4-D is about 130 acres (Table 2-6). 2,4-D is a selective, systemic herbicide used to control broadleaf weeds in a wide range of plant families (USDA Forest Service 2006). 2,4-D works by affecting plant growth processes. Plant roots are usually more sensitive to 2,4-D than shoots, although above ground vegetation shows typical signs of 2,4-D soon after application (e.g. wilting and chlorosis) as the active ingredient impacts plant growth.

Only amine-based, aquatic formulations of 2,4-D are used in the SCNF. Due to its low toxicity and environmental fate profile, aquatic formulations of 2,4-D are used for weed control primarily in riparian areas and wetlands within 15 feet of surface water. It is also used to control broadleaf weeds in the spring when plants are still young and actively producing basal vegetation. 2,4-D has very limited soil residual capability (USDA Forest Service 2006) and is useful for sites where herbicide is not desired to remain active in the soil.

Woody species are generally tolerant of 2,4-D applied at rates used to control forbs, although damage can occur to seedlings and saplings. Conifers and evergreen shrubs are more tolerant than deciduous species; deciduous trees and shrubs may exhibit signs of injury on sprayed foliage.

Grass species are generally very tolerant to 2,4-D after the seedling stage of growth. However, grass seed production may be affected when applied to grasses in the boot to dough or milk stage (NuFarm 2010). Grasses are not affected when 2,4-D is applied after grass is established or when not in the flowering stage.

As a broadleaf herbicide, 2,4-D has the potential to affect many different forb species. Mortality (or the degree of injury) depends on the use rate and the application method. 2,4-D can be quite toxic to plants, but spot applications and the fact that it does not remain active in the soil make precision applications possible in settings where non-target damage needs to be minimized. 2,4-D is used in a mix with other herbicides to stop seed production quickly while the other herbicide in the mix provides soil residual capability.

Chlorsulfuron

Chlorsulfuron is the sulfonylurea-class herbicide most often used by the SCNF with an average annual output of 102 acres (Table 2-6). Chlorsulfuron is a selective herbicide formulated as a dry flowable (i.e. small granular pellets) that controls an array of broadleaf weeds (DuPont 2011). It is in the sulfonylurea class of herbicides and works by inhibiting an enzyme, acetolactate synthase, which is essential for plant growth (SERA 2004a). Chlorsulfuron can be applied as a pre- or post-emergent treatment (DuPont 2011). It works best on plants in the early or vegetative stages of growth. Chlorsulfuron is one of only a few herbicides in use in the SCNF that controls weeds in the mustard plant family. It is also very useful in controlling weeds in the borage family.

Chlorsulfuron is taken up in both the foliage and roots of susceptible plant species. Chlorsulfuron also incorporates into the soil and provides a period of soil residual activity. This period is typically short, at most, a year. Since chlorsulfuron remains active in the soil for some time, it can be transported away from the treatment site in wind or water erosion. The herbicide label cautions users when making applications to powdery or light, sandy soils (DuPont 2011).

Chlorsulfuron can be used up to the water's edge and can be applied to seasonally wet areas when no surface water is present (DuPont 2011). This, and the tolerance that woody species have to chlorsulfuron, makes it a valuable herbicide for treatment in riparian areas or wetlands.

Woody species are tolerant of chlorsulfuron applied at typical use rates for most broadleaf weeds, although seedlings and saplings could be injured or killed by overspray that covers the foliage and stems.

Graminoids are also tolerant of chlorsulfuron, although graminoids stressed by environmental conditions may be injured and experience temporary setbacks in vigor and growth. Chlorsulfuron can injure or kill seedling grasses that have not yet established sufficient root systems. It may also affect seed production in some grasses, depending on the use rate and the stage of seed production.

Members of the borage, mustard and pea plant families are the most susceptible to chlorsulfuron, while many members of the sunflower family are tolerant at typical use rates. Annual broadleaf weeds are best controlled by chlorsulfuron when in early stages of growth. Perennial weeds are best controlled when in a rosette stage in the spring or fall or prior to the bloom stage.

Clopyralid

Clopyralid is the second most used herbicide in the SCNF, with an average annual output of 284 acres (Table 2-6). Clopyralid is a systemic herbicide that controls broadleaf weed in a number of plant families (SERA 2004b, DowAgro Sciences 2011). It is in the same class of herbicides as aminopyralid, picloram and triclopyr and functions by interfering with plant growth (Trevathan 2002a). Plant uptake of clopyralid occurs in both the foliage and the roots (Dow AgroSciences 1997). Members of the sunflower and pea plant families are most susceptible to clopyralid while members of the mustard family are tolerant (TNC Clopyralid Technical Bulletin 2001b). Clopyralid is more selective than other herbicides in this same class, such as picloram or triclopyr (TNC Clopyralid Technical Bulletin 2001b).

Clopyralid exhibits much less soil residual capability than aminopyralid or picloram. At best, residual control is usually one year or less. Like other members in the same class of herbicide, clopyralid can be mobile in permeable soil and the label recommends caution in making applications in cobbled soil where the water table is shallow (Dow AgroSciences 2011a).

Woody species are generally tolerant of clopyralid (with the exception of trees and shrubs in the Pea family), although transitory or temporary damage may occur. Clopyralid is labeled for weed control in deciduous tree plantations since deciduous trees are tolerant (Dow AgroSciences 2011a). Likewise, conifers are tolerant of clopyralid. The SCNF regularly uses clopyralid in forest settings, riparian areas with deciduous overstory and in cover types with deciduous brush.

Newly seeded grass that is not yet well established may be injured by clopyralid, but graminoid species are otherwise tolerant to clopyralid (Dow AgroSciences 2011a).

Clopyralid controls broadleaf weed species. Clopyralid is most active on members of four plant families: the buckwheat, nightshade, pea, and sunflower families (Dow AgroSciences 1997). Conversely, mustards are not at all susceptible to clopyralid. Compared to picloram, clopyralid is less harsh and is used in settings where the use of picloram could result in severe non-target effects.

A number of field studies from western Montana by Rice and his colleagues have researched the effects of herbicides, including clopyralid, on target and non-target forbs, Rice and Harrington (2007) found broadcast applications of clopyralid reduced native plant abundance less than picloram. Rice et al. (1997) also found that reductions in plant community diversity were small and short-term. Rice and Toney (1998) found that lower rates of picloram and clopyralid still provided three years of control on spotted knapweed.

Dicamba

Currently, dicamba is used very little in the SCNF with an average annual output of only about 7 acres. Dicamba is a selective herbicide used in control of broadleaf weeds and some woody species (SERA 2004c). There are two forms of dicamba, both of which are approved for use by the Forest Service , a diethylamine salt and a diglycolamine salt (SERA 2004c). The diglycolamine form is preferred because volatilization potential is much lower compared to the diethylamine form (SERA 2004c). Dicamba translocates through foliage, stems and roots to growing points.

Dicamba is active in the soil and if sprayed around non-target plants it may move laterally and downward and affect the root systems of non-target plants, potentially resulting in injury or death (NuFarm 2011b). However, dicamba is not persistent in the soil and does not provide residual control.

Dicamba can leach in permeable soils under some environmental conditions, so it is not suitable for use next to water (NuFarm 2011b). Label direction recommends caution when considering dicamba applications in areas with permeable soils and shallow water tables. Label direction for the diethylamine form of dicamba specifies that it may not be applied to soils classified as sand containing less than 3% organic matter where water tables are shallow (Arysta LifeScience Undated).

Graminoids (grass, sedges, rushes) are generally tolerant of dicamba, although graminoids stressed by environmental conditions (e.g. insect outbreaks or drought) may be injured and experience temporary setbacks in vigor and growth. Dicamba can injure seedling grasses that have not yet established sufficient root systems.

Dicamba is an effective herbicide that controls a wide variety of broadleaf weeds in a number of different plant families. Correspondingly, native forbs are likely to be injured or killed by dicamba applications.

Dicamba is a broad-spectrum herbicide that controls trees and brush and, as such, woody conifer and deciduous species are generally susceptible to dicamba (NuFarm 2011b). There are several methods for applying dicamba to woody weed species depending on the presence and type of non-target woody vegetation present. The two primary methods are cut surface or directed foliar spray

techniques (SERA 2004c). Cut surface application methods provide a high degree of protection to surrounding non-target vegetation while directed foliar spray methods may be used when the potential for non-target damage is not a concern. For example, cut surface treatments on salt cedar would be appropriate when salt cedar occurs mixed in with native trees or shrubs while directed foliar spray would be appropriate should salt cedar occur in stands unmixed with native trees or shrubs.

Glyphosate

Glyphosate is little used in the SCNF (with an output of less than 3 average applied acres) because it is a broad-spectrum, non-selective, post-emergence herbicide that can kill or injure vegetation to which it is applied (NuFarm 2011a). It is used primarily in the SCNF in riparian areas since under the Current Action only 2,4-D and glyphosate can be used within 15 feet of water. Glyphosate only works when applied to living plant tissue. It cannot be used as a pre-emergent herbicide or as a soil residual herbicide. Glyphosate works by affecting the production of aromatic amino acids essential to plant growth (SERA 2011a). At present, glyphosate is the only non-selective herbicide in use in the SCNF. Broadcast applications of glyphosate are not made in the SCNF since it is non-selective herbicide.

Glyphosate molecules bind strongly to soil particles, which prevents leaching into areas where it was not applied or into groundwater (Trevathan 2002b, NuFarm 2011a). Glyphosate is not mobile in soil and provides no soil residual activity as glyphosate molecules bind very strongly to soil particles (NuFarm 2011a).

Woody species can be injured or killed by glyphosate when sprayed on living tissue. Younger age classes (seedlings/saplings) are likely to be killed. Actively growing foliage on mature plants that is affected by direct spray or drift may be injured, resulting in leaf drop and branch tip necrosis. Spraying thick woody or corky bark with glyphosate will not affect trees and shrubs. However, spraying thin or green bark that is metabolically active could result in injury or, in the case of seedling/sapling trees or shrubs, in mortality. There is no root uptake of glyphosate, so it can be sprayed under foliage and inside the drip line (i.e. circumference of foliage). The SCNF is currently allowed to use only glyphosate and aquatic formulations of 2,4-D within 15 feet of water so deciduous species may unavoidably be affected by applications of glyphosate. Conifer species would be similarly affected; however, in the SCNF glyphosate applications are not generally made in conifer cover types.

Glyphosate is a non-selective herbicide that can kill or damage graminoids, sometimes even at low use rates. Formulations manufactured without surfactant are generally less toxic since surfactants can increase the toxicity of glyphosate (SERA 2011a). Adding a surfactant to glyphosate or applying glyphosate at higher use rates will increase the degree of injury or mortality to grasses.

As a non-selective herbicide, glyphosate kills most forb species. Selectivity can only be achieved through avoidance of non-target vegetation; including the use of targeted spot applications, barriers and timing of glyphosate applications. For example, since glyphosate has no soil residual capability, it will have no effect to non-target forbs when applied during periods when these species are dormant.

Imazapic

Imazapic is regularly used in the SCNF with an average annual output of 137 acres (Table 2-6). Imazapic is a systemic herbicide that provides selective pre- and post-emergence control of annual grasses (particularly cheatgrass and medusahead), some perennial grasses, and some broadleaf weeds. Imazapic inhibits amino acid production necessary for protein synthesis and cell growth (SERA 2004d). Imazapic is taken up in the foliage, stems, and roots of susceptible plant species. A surfactant must be used in post-emergent applications, most commonly a seed or vegetable oil (BASF 2011).

Imazapic incorporates into the soil and provides a moderate period of soil residual activity (one to two growing seasons). Imazapic is not known to move laterally in the soil or leach deeply downward, so it remains within the treatment area (TNC Imazapic Technical Bulletin 2004).

Imazapic can be applied to seasonally wet, low-lying areas where the water has drained (Plateau Specimen Herbicide Label 2011). However, since imazapic can be mobile in water, it is not recommended for use up to water's edge.

Woody species are generally tolerant of imazapic applied at typical use rates for most graminoid and broadleaf weeds (BASF 2011), although seedlings and saplings could be injured or killed by overspray that covers the foliage and stems. Dormant trees are much less likely to be injured. Direct spray to foliage could result in minor damage. Trees or shrubs that are usually tolerant to imazapic, but which are experiencing physiological stress due to environmental conditions (e.g. drought, storm damage, or insect or disease outbreaks) may become susceptible to injury.

As a selective herbicide, imazapic controls a specific range of annual and perennial grasses and forbs (BASF 2011). Imazapic can be mixed with other herbicides such as picloram to provide dual control of annual grasses and weeds in the sunflower and mustard plant families in a single application (TNC Imazapic Technical Bulletin 2004). Post-emergent applications must be made to perennial weed species (BASF 2011).

In some cases, target weed species are susceptible to imazapic while desirable native species are tolerant to this active ingredient. This makes imazapic very valuable for restoration projects in which weed control is required as a site preparation measure. For example, many native graminoids and forbs are tolerant of imazapic and can be seeded at the same time as imazapic is applied. Caution must be used, however, if herbicides with soil residual capability have been applied recently since compounded injury or mortality of newly seeded vegetation could result.

Imazapic is also used as a component of integrated management for leafy spurge (TNC Imazapic Technical Bulletin 2004). Leafy spurge is a rhizomatous, very deep-rooted weed that is very difficult to control. Fall applications of imazapic can be followed by seeding with graminoids to provide vegetation can compete with leafy spurge. Additionally, imazapic applications can assist with the establishment of biological control agents for leafy spurge by modifying stand structure of the weed infestation.

Metsulfuron-methyl

Currently metsulfuron-methyl is little used in the SCNF with an average annual output of only about an acre (Table 2-6). Metsulfuron-methyl is in the same sulfonylurea class of herbicides as chlorsulfuron and is very similar to chlorsulfuron. It is a selective herbicide formulated as a dry flowable (i.e. small granular pellets) that controls an array of broadleaf weeds (DuPont 2012). It

works by inhibiting an enzyme, acetolactate synthase, which is essential for plant growth (SERA 2004e). Metsulfuron-methyl is applied as a post-emergent treatment (DuPont 2012), unlike chlorsulfuron which also works as a pre-emergent herbicide. Metsulfuron-methyl activity is promoted by warm, moist conditions and is slower in cooler, dry weather (Trevathan 2002d). Metsulfuron-methyl works best on plants in the early or vegetative stages of growth. Metsulfuron-methyl is one of only a few herbicides in use in the SCNF that controls weeds in the mustard plant family. It is also very useful in controlling weeds in the borage family.

Metsulfuron-methyl is taken up in both the foliage and, to a lesser degree, roots of susceptible plant species. It also incorporates into the soil and provides a period of soil residual activity. This period is approximately, only one to two growing seasons. Since metsulfuron-methyl remains active in the soil for some time, it can be transported away from the treatment site in wind or water erosion. The herbicide label cautions users when making applications to powdery or light, sandy soils (DuPont 2012). Metsulfuron-methyl is also more mobile in alkaline soils as compared to acidic soils (Trevathan 2002d) since it breaks down more quickly in moist, acidic environments.

Metsulfuron-methyl can be used up to the water's edge and can be applied to seasonally wet areas when no surface water is present (DuPont 2012). This makes it a valuable herbicide treatment in riparian areas or wetlands.

Woody species are generally tolerant of metsulfuron-methyl applied at typical use rates for most broadleaf weeds, although seedlings and saplings could be injured or killed by overspray that covers the foliage and stems. Conifers are more tolerant than deciduous species. Metsulfuron-methyl is labeled for weed control in conifer plantations, including Douglas-fir and ponderosa pine, two conifer species common in the SCNF (DuPont 2012). However, conifer trees or shrubs that are experiencing physiological stress due to environmental conditions, such as drought or insect or disease outbreaks, may be susceptible to injury from metsulfuron-methyl.

While metsulfuron-methyl may injure some deciduous tree or shrub species, it generally must be tank mixed with another herbicide (e.g. glyphosate or imazapyr) and applied as a canopy overspray to kill them (DuPont 2012). Such applications are not made to native deciduous trees or shrubs.

Graminoids are also tolerant of metsulfuron-methyl, although graminoids stressed by environmental conditions may be injured and experience temporary setbacks in vigor and growth. Metsulfuron-methyl can injure or kill seedling grasses that have not yet established sufficient root systems. It may also affect seed production in some grasses, depending on the use rate and the stage of seed production.

Members of the borage, mustard, and pea plant families are the most susceptible to metsulfuron-methyl, while many members of the sunflower family are tolerant at typical use rates for most broadleaf weeds. Annual broadleaf weeds are best controlled by metsulfuron-methyl when in early stages of growth. Perennial weeds are best controlled when in a rosette stage in the spring or fall or prior to the bloom stage.

Picloram

Picloram is the herbicide most often used in the SCNF, with an average annual output of 411 acres (Table 2-6). Picloram is a systemic herbicide that provides excellent control of broadleaf and woody weed species in a number of different plant families (Dow Agro Sciences 2009). It is in the same

class of herbicides as aminopyralid, clopyralid and triclopyr. It functions by interfering with plant growth processes and is particularly active on broadleaf plants in the sunflower family and pea family, providing excellent control of weeds such as spotted knapweed at low use rates. It also works very well on deep-rooted perennial weed species such as leafy spurge and toadflax that are very difficult to control. Plant species in the mustard family are tolerant of picloram and must be controlled with other herbicides.

Picloram is moderately to highly active in the soil (Trevathan 2002e) and can provide one to two years of residual control, reducing weed control costs. However, since picloram is persistent in the soil and because it is also very mobile in water, it can move through permeable soils into groundwater (TNC Picloram Technical Bulletin 2001a, Dow AgroSciences 2009). For these reasons and because picloram is highly toxic to plants, picloram is a restricted use herbicide that can only be used by trained and licensed herbicide applicators.

Since picloram controls woody species as well as broadleaf forbs, picloram can injure evergreen and deciduous tree and shrub species. Care must be taken during applications to control forbs to avoid spraying picloram on trees and shrubs and to remain well outside the drip line (i.e. outer circumference of the foliage). Mature plants are less susceptible than seedlings or saplings. Tolerance to picloram varies by species as well. Mountain mahogany and bitterbrush are highly susceptible to picloram while many sagebrush species are tolerant to picloram at the rates applied to control broadleaf weeds.

Graminoids (grass, sedges, rushes) are generally tolerant of picloram (Dow AgroSciences 2009). Graminoid growth and biomass may be set back by picloram, but effects are temporary. Since picloram is so toxic to forbs, while graminoids are tolerant, picloram applications favor graminoids. Graminoid abundance and density in a plant community often increase when broadleaf weeds such as spotted knapweed are controlled with picloram. While this can be a favorable outcome, for example, when native grasses replace spotted knapweed, there can also be unintended side effects. Researchers have noticed secondary invasion of non-native weedy mustards and cheatgrass (Pearson and Ortega 2009), especially when picloram is applied at high rates or applied repeatedly without a rest and recovery period. This is most likely to occur in areas that are highly infested with weeds such as spotted knapweed and with little desirable relict vegetation.

Picloram is highly toxic to forbs, even at low use rates (12- 16 oz./acre). One notable exception is the mustard family. Non-native invasive plants as well as native members of the mustard family are tolerant of picloram. Numerous studies have examined the effects of picloram to target and non-target forbs in other plant families, particularly in the sunflower family. Results from short-term and long-term studies in western Montana all note the effectiveness of picloram to target broadleaf weeds and the potential injury or mortality it may cause to non-target forbs (Rice et al. 1992 and 1997, Sheley et al. 2000, Crone et al. 2009, Ortega and Pearson 2010 and 2011). Broadcast applications of picloram result in much greater impacts to non-target plant species than spot applications (Ortega and Pearson 2011).

Rice and his colleagues have studied spotted knapweed control in western Montana for several decades, using a variety of herbicides, including aminopyralid, clopyralid, dicamba, and picloram (Appendix L). Their research results show that plant communities are capable of recovery after weed invasion and weed control, including picloram applications. Picloram can provide effective

control of weeds for multiple years and a recovery period between re-applications allows desired and native plant species to re-establish.

A ten-year study on big game winter range on the Lolo National Forest showed that lower picloram use rates provided good weed control for up to three years and had less effect on plant community diversity and more rapid recovery rates than higher application rates (Rice 2012). To counteract secondary invasion, imazapic was mixed with picloram and provided early reductions in cheatgrass.

Sulfometuron-methyl

Under the Current Action alternative, very little sulfometuron-methyl is used in the SCNF, other herbicides in this family are preferred. There was no applied acreage using sulfometuron-methyl between the years 2010 and 2012. Sulfometuron-methyl is in the same sulfonylurea class of herbicides as chlorsulfuron and metsulfuron-methyl. It is a broad-spectrum, non-selective herbicide (SERA 2004f). It is formulated as a dispersible granule that controls a wide range of graminoid and broadleaf weeds (DuPont 2013). It works by inhibiting an enzyme, acetolactate synthase, which is essential for plant growth (SERA 2004f). Sulfometuron-methyl is taken up in both the foliage and roots. Sulfometuron-methyl is one of only a few herbicides in use in the SCNF that controls weeds in the mustard plant family. It is also very useful in controlling weeds in the borage family.

Sulfometuron-methyl can be used for pre- and post-emergent weed control and is applied at very low rates (DuPont 2013). For post-emergent applications, sulfometuron-methyl provides the best control when applied to weeds in the early stage of growth. Higher use rates are required when making applications to established plants. Sufficient soil moisture is required to activate sulfometuron-methyl and move it into the root zone, especially for pre-emergent applications.

Sulfometuron-methyl incorporates into the soil and provides a period of soil residual activity. This period is typically short, only oneto two growing seasons. Since it remains active in the soil for some time, it can be transported away from the treatment site in wind or water erosion. The herbicide label cautions users when making applications to powdery or light, sandy soils (DuPont 2013).

Sulfometuron-methyl can be applied to seasonally wet areas when no surface water is present. When surface water is present, the label direction requires a 15-foot buffer from the water's edge when making hand-held spot applications. The label specifies this buffer when applying sulfometuron-methyl near water to protect aquatic vegetation and surface water from drift (DuPont 2013).

Conifer species are generally tolerant of sulfometuron-methyl applied at typical use rates for most graminoid and broadleaf weeds, although seedlings and saplings could be injured or killed by overspray that covers the foliage and stems. Dormant trees are much less likely to be injured. Common conifers in the SCNF, such as Douglas-fir, lodgepole pine, and ponderosa pine, are tolerant of sulfometuron-methyl and it is labeled for weed control in conifer plantations (DuPont 2013). However, conifer trees or shrubs that are experiencing physiological stress due to environmental conditions, such as drought or insect or disease outbreaks, may be susceptible to injury from sulfometuron-methyl. The addition of a surfactant increases the risk of injury or mortality.

Deciduous trees and shrubs are less tolerant than conifers overall. Some deciduous species are tolerant of sulfometuron-methyl while others are susceptible. Tolerance or susceptibility depends on the species, age class, season of application, use rate, and environmental stress. Seedlings and

saplings could be injured or killed by overspray that covers the foliage and stems. Dormant trees are much less likely to be injured. Trees or shrubs growing in acidic soils are more susceptible to sulfometuron-methyl. Trees or shrubs that are experiencing physiological stress due to environmental conditions, such as drought or insect or disease outbreaks, may be susceptible to injury from sulfometuron-methyl. The addition of a surfactant increases the risk of injury or mortality.

As a broad-spectrum, non-selective herbicide, sulfometuron-methyl is toxic to many annual and perennial graminoid and broadleaf species. Since moisture is necessary for activation of sulfometuron-methyl, this herbicide in arid regions (less than 20" precipitation per year) must be used in seasons when soils are moist and some level of precipitation can be expected (DuPont 2013). Higher use rates may be required to provide control in arid regions.

Triclopyr

Currently, very little triclopyr is used in the SCNF, with no applied acreage between the years 2010 and 2012. Triclopyr is a selective, systemic herbicide used in the control of aquatic, broadleaf and woody weed species. Triclopyr works by disrupting plant growth processes. Triclopyr breaks down quickly and does not typically persist in the soil for more than a few weeks to a few months. Triclopyr does persist in plant material until it dies and begins to decay (TNC Triclopyr Technical Bulletin 2001c).

Triclopyr comes in two forms (SERA 2011d), but only the amine is used in the SCNF salt form as the ester form volatilizes easily. Both forms degrade rapidly to the parent compound, triclopyr acid, in the soil (TNC Triclopyr Technical Bulletin 2001c). Triclopyr can leach in permeable soils (Dow AgroSciences 2011b). The amine salt form is more mobile in soil than the ester form (Trevathan 2002g); however leaching is considered minor in a field setting (TNC Triclopyr Technical Bulletin 2001c). Label direction recommends caution when considering triclopyr applications in areas with permeable soils and shallow water tables. Triclopyr is also considered highly mobile in water, the amine form more so than the ester form (Trevathan 2002g), although is not a problem since it degrades very quickly to the parent acid in an aquatic environment and does not persist (TNC Triclopyr Technical Bulletin 2001c).

As an aquatic herbicide, triclopyr can be applied directly to water to control aquatic weeds. Triclopyr can also be applied to seasonally dry wetlands (e.g. floodplains) and to transitional areas (Dow AgroSciences 2011b) to control broadleaf and woody weed species.

Triclopyr has very little to no effect on graminoids. Likewise, triclopyr is primarily an herbicide for the control of woody species and controls only a limited number of broadleaf weeds in a few plant families. Triclopyr would be seldom used to control broadleaf weeds.

Triclopyr is a selective herbicide that controls trees and brush and, as such, woody conifer and deciduous species are generally susceptible to triclopyr (Dow AgroScience 2011b). The amine form of triclopyr does not readily penetrate woody plant cuticles, so directed foliage sprays with the addition of an effective surfactant or cut surface treatments are needed (TNC Triclopyr Technical Bulletin 2001c). The method of application depends on the presence and type of non-target woody vegetation. Cut surface application methods provide a high degree of protection to surrounding non-target vegetation while directed foliar spray methods may be used when the potential for non-target damage is not a concern present (SERA 2011d, Dow AgroSciences 2011d). For example, cut

surface treatments on salt cedar would be appropriate when salt cedar occurs mixed in with native trees or shrubs while directed foliar spray would be appropriate should salt cedar occur in stands unmixed with native trees or shrubs.

Treated Acreage and Applied Acreage

For clarification, it is important to note that there is a difference between treated acres and applied acres (NFS Invasive Species Management Record-Keeping Business Rules and National Standards 2014). Treated acres represent the area that is occupied by invasive plants independent of plant density. Applied acres represent the actual land area that received herbicide treatment. When spot treatment methods are used the applied acres may be significantly less than the treated acres. When using broadcast spraying the treated acres and applied acres are generally the same.

Currently, the SCNF accomplishes an applied acreage of approximately 1,000 acres annually using primarily five of the ten approved herbicides (Table 2-6). The herbicides most commonly used include, in order of applied acreage, picloram, clopyralid, imazapic, 2,4-D and chlorsulfuron (based on average applied acres by herbicide). The gross or treated acreage is approximately 6,000 acres annually. The difference between applied and treated acres results from the fact that most of the SCNF herbicide application is spot treatment, so herbicide is not applied to all acres covered, but rather to less than 20% of the total acres covered (USDA Forest Service SCNF NRIS database 2012). Overall, it also means that herbicides are presently applied to only about 1/300 of one percent of the total project area annually.

In terms of the total acreage in the project area known to be infested by noxious weeds (49,219 acres), the average amount treated annually is approximately eight percent. It is not possible or even necessary all infested acres to be treated annually. The use of herbicides with soil residual capability means that more than one season growing season or year of control can be obtained by a single herbicide application. A realistic control objective for widely distributed invasive plant species that cannot be eradicated is to maintain density at levels that do not interfere with the structure and function of desired plant communities and the delivery of ecosystem services (ISDA 2012). This aligns with research that shows that suppression of invasive plants with occasional herbicide applications can still provide for functioning plant communities while reducing herbicide impacts to non-target forb species (Crone et al. 2009).

The annual applied and treated acreage varies depending on funding and availability of resources. Table 2-3 displays the three-year average annual applied herbicide output by upland and riparian applications.

Mechanical Control

In the SCNF, mechanical control is seldom used as the sole treatment methods and is often integrated with other control methods, usually herbicide application. Annually, the SCNF averages about 36 acres of mechanical control across the project area.

Mechanical control may also be used when a new infestation is detected and other treatment options are not readily available at the time. In addition, mechanical control is used when sensitive plant species are present and the location or the timing is not appropriate for the use of herbicides.

Mechanical control includes a variety of methods. The most common mechanical control method utilized in the SCNF is hand pulling followed by cutting or mowing, including removing seed heads of plants that are nearing or at the seed maturation stage and then bagging and removing to prevent new additions to the seed bank. The least common technique used is torching. As more infestations near eradication, mechanical control becomes a more viable approach.

Rehabilitation and Restoration Practices

The objective of rehabilitation and restoration practices is to achieve site recovery (i.e. desired condition) in a timely manner, to protect soil resources and to promote functioning, invasive plant-resistant plant communities. Under the Current Action alternative, the SCNF employs rehabilitation and restoration measures when necessary to meet management objectives for a particular area of land infested by invasive plant species. These measures may range from a temporary or permanent administrative action (such as blocking inappropriate motor vehicle use) to planting seeds or plants.

Direct and Indirect Effects

Biological Control

Within the project area, biological control agents have no direct effects to non-target plants. The U.S. Animal and Plant Health and Inspection Service (APHIS) regulates the approval process for biological control agents carefully since, in the past, some agents have been found to shift to non-target plants that are closely related to the host plant species (Simberloff and Stiles 1996). There are no biological control agents in use on in the SCNF that are known to attack non-target plants. However, a successful biological control agent, a root-feeding weevil, released in Canada to control houndstongue has been found to jump to native borage species (APHIS 2010). Although this agent will not be approved for use in the U.S., the weevils are naturally migrating southward from Canada into the northwestern United States and may eventually reach the SCNF system lands (APHIS 2010).

The effect of biological control agents on native plant communities is usually expressed indirectly. If agents are successful in reducing seed production, impacting host plant vigor or slowing the rate of spread, then desirable plant communities may be better able to withstand the impacts associated with invasive plant infestation and maintain a viable presence in the altered plant community. However, unless a biological control agent is very successful this beneficial effect may be minor. The indirect benefits may also be short-lived or cyclical as populations of biological control agents naturally fluctuate based on environmental conditions and host plant populations.

Other indirect effects of biological control can be subtle and difficult to tease out. McEvoy and Combs (1999) noted that as the number of biological control agents released in the same location for the same target species increases, so too could the potential competitive effects between agents. In a review of studies of competition among biological control agents, Stephens and Meyers (2014) noted that synergistic effects to the target species may be a less likely outcome than antagonistic relationships between agents that reduce the impact of biological control to the target plant species.

Seastedt et al. (2007) investigated the relationship between two or more biological control agents. These researchers found *Larinus* flower head weevils directly competed with or preyed on *Urophora* seed head gall flies in a study of the effects of multiple biological control agents on diffuse and spotted knapweeds. This study underscores that unanticipated inter-relationships among biological

control agents may result when attempts are made to establish a suite of agents for control of an invasive plant species.

The relationship between biological control agents, the host plant species and varying environmental factors are likewise complex and often poorly understood. This can yield unexpected results. Callaway et al. (1999) found that insect agents could increase the competitive ability of spotted knapweed. This study found that when *Agapeta zoegana*, a moth whose larvae feed on the roots of spotted knapweed, neighboring Idaho fescue (*Festuca idahoensis)* plants actually did more poorly than when grown with spotted knapweed that was not targeted by biological control agents. Instead of releasing the neighboring grass plants from competition and allowing it to thrive as intended, the insect had no detectable impact on spotted knapweed and may have indirectly suppressed the Idaho fescue. The spotted knapweed plants probably responded to the minor damage from the herbivory by increasing production of allelopathic compounds. The introduction of the biological agent acted as a stressor to the knapweed and in response the plants produced more allelopathic compounds which may have negatively affected the Idaho fescue. Sing et al. (2005) noted cases where release of biological control agents may have enhanced the fitness of individual invasive plants in response to the stress imposed by the agent.

It has been suggested that biological control agents could be having negative indirect effects on some desirable species in ways that are not yet recognized (Pearson and Callaway 2003, Morin et al. 2009). These include not only the compensatory responses shown in Callaway et al. 1999 above, but also ecological replacement (Callaway et al. 2003) and changes in food web interactions. A well-known example of ecological replacement is the changes made by flycatchers and other birds in the southwestern United States to nesting in salt cedar bushes in places where native cottonwood habitat is scarce (Ellis 1995). An example of food web changes involves the predation by native deer mice on the larvae of knapweed seed head gall flies (*Urophora* spp.), which overwinter in the flower heads of knapweed plants (Pearson et al. 2000, Ortega et al. 2004). The deer mice began targeting and consuming the larva of the biological control agent, yielding the unexpected effect of an increase in the deer mice population.

Finally, even if biological control agents do establish and disperse, providing at least some degree of effective control on the target species, a full component of desirable plant species may not readily re-establish on sites that have been highly impacted by invasive plants. As an example, over the course of a nine-year study, Butler and Wacker (2010) found that desirable forb species did not recover easily on a site heavily infested with leafy spurge after release of biological control agents. The treatment was very successful in reducing leafy spurge stem density and foliage cover by 80 to 90 percent over the course of the study. In response, graminoid cover increased by almost 60 percent. However, forbs did not re-establish on the site. Leafy spurge exhibits allelopathy and researchers have long known that well established infestations of leafy spurge inhibit forbs while grass species are better able to persist. Based on their findings, Butler and Wacker recommended that managers initiate control on invasive plant infestations as soon as possible to avoid loss of the native vegetation component. Since biological control is usually implemented on sites where other methods of control may not be easily accomplished (e.g. large infestations on sites highly impacted by invasive plants), this can be difficult to achieve. Active rehabilitative or restoration measures may be required as part of IWM to assist re-establishment of desired plant species.

Another indirect effect is the supporting role that biological control has in reducing the frequency of herbicide applications as part of IWM. Biological control and herbicide applications can be a very

effective combination of invasive plant control (Reinhardt 2000) and these two control strategies are integrated in the SCNF. Established populations of effective biological control agents can increase the interval between herbicide applications and allow herbicide use rates to be reduced, thus providing for better recovery of native plants (Ainsworth 2003).

The use of biological control agents is intended to be flexible and allow managers the ability to respond to changing priorities or to new information regarding biological control agents or other treatment methods. Biological control agents could potentially be released throughout the project area. Biological control agents may be used to enhance other treatments or may serve as the sole invasive plant treatments in some areas.

Biological control agents, as a sole treatment, are not expected to meet control objectives in the project area. However, the use of biological control agents that are successful in suppressing plant vigor, seed production and density can contribute to long-term invasive plant management. Biological control agents can be an important part of integrated weed management across ownership boundaries, contributing to the success of other treatments.

Herbicide Control

Herbicide application, practiced properly, is an important tool in managing invasive plants. Selective control of invasive plants that allows desired vegetation to recover from invasive plant invasion and re-establish strongly after invasive plant treatment, can be accomplished by applying appropriate herbicides at appropriate rates and by using appropriate application techniques to minimize as much as possible impacts to non-target vegetation.

Direct effects to non-target vegetation include damage or mortality, reduced plant growth, reduced biomass and vigor, and reduced reproductive success. Direct effects can be minimized or alleviated by utilization of prevention practices (Appendix C), the design criteria (Appendix J), and application techniques. These include limited impacts to target species through herbicide selection, using the lowest application rate possible, using equipment and application techniques that reduce exposure to non-target vegetation or timing the season of herbicide application to seasons when desirable plants will be less susceptible to damage by herbicides. For example, invasive plants are most susceptible to the direct effects of herbicides when they are actively growing (Duncan et al. 2005). Fall application of some herbicides can selectively kill invasive plants that re-initiate growth in the fall, while not affecting some native species that are dormant after spring and summer growth (Rice and Toney 1998). However, impacts to non-target plant species on herbicide treated sites will occur and are not completely avoidable.

Unintentional application or drift of herbicide from the application site can directly expose non-target vegetation to toxic levels of herbicide. Spray drift is managed by using design criteria and application techniques that minimize the potential for drift. Applicators check local weather conditions daily and monitor site-specific conditions at the work area throughout the day. Adherence to label instructions and design criteria (e.g. applying at lower pressure and using the largest appropriate nozzle size, adjusting nozzle angle, adding spray adjuvants designed to reduce drift) minimizes impacts to non-target vegetation. When weather conditions in a work area approach the maximum levels set by design criteria (Appendix J), spray operations are stopped. Additionally, in the SCNF herbicides formulated as esters, which are much more likely to volatilize,

or carriers other than water, are not used. Both of these measures further reduce the possibility of spray drift.

With the exception of glyphosate, the herbicides used in the SCNF maintain some degree of residual herbicidal activity in soil for at least short periods of time. This period of residual activity is desirable and important because it provides a longer window of control after an herbicide application and can greatly improve the efficacy of the treatment for several reasons. Germinating seeds and very young plants are most likely to be killed by residual herbicide activity, which helps reduce the amount of viable seed banked in the soil. Herbicide residual activity also helps reduce costs and may increase the interval between herbicide applications, resulting in a need for fewer applications.

Many studies have been conducted to determine the residual activity of herbicides and the amount of time various herbicides remain active in natural settings. This information is contained in Forest Service herbicide risk assessments (Table 3-1). Of the herbicides used in the SCNF, picloram has the longest period of soil residual activity (Tu 2001a); with the potential to provide invasive plant control well into the year after it has been applied. In effect, this provides two control windows for the time and cost of a single application. For this reason, picloram is very useful for reducing the amount of viable seed stored in the soil and it is commonly used to control invasive plant species in the borage, spurge and sunflower plant families. Other herbicides used in the SCNF also provide this residual benefit, albeit at much weaker levels. Clopyralid, chlorsulfuron, metsulfuron-methyl, and imazapic, for example, can provide more than one season of weed control. Other herbicides, such as 2,4-D, break down very quickly and provide little residual control while glyphosate provides no soil residual activity.

Non-target vegetation can be affected by residual herbicide activity (Bussan and Dyer 1999). Herbicides that are short-lived and become detoxified in a few days or weeks, such as 2,4-D, have less potential to indirectly affect non-target vegetation through soil activity. Other herbicides, such as picloram, can remain active in the soil for more than one year. As an example, native plants that were dormant during a late summer herbicide application could be damaged by residual amounts of picloram the following spring when plant growth resumes. Non-lethal damage could include reduced biomass, vigor and reproductive success. However, studies from western Montana using picloram, clopyralid and 2,4-D found no evidence of long-term damage from residual herbicide concentrations at the plant community level (Rice et al. 1992, Rice et al. 1997, Rice and Toney 1998).

Indirect effects can be beneficial or detrimental and can be more difficult to observe and ascertain than the direct effects of an herbicide application. For example, an impacted plant may have difficulties with photosynthesis and in acquiring and storing nutrients or water (Bussan and Dyer 1999). Its competitive ability may be reduced for a period of time. Detrimental indirect effects to non-target vegetation from herbicide application may involve a prolonged period of recovery to restore biomass and regain the root reserves needed to resume seed production or vegetative reproduction. Note, however, that plants stressed by drought, fire or invasive plant invasion may already have experienced reduced biomass, vigor and reproductive success, so it can be difficult to assign a single causation.

Beneficial indirect effects of herbicide application include an increased availability of water and nutrients that were claimed by the more competitive invasive plants (Bussan and Dyer 1999). Canopy cover of invasive plants is reduced, allowing desirable plants greater access to sunlight for photosynthesis.

In addition to increased water, nutrients and sunlight, invasive plant control may also increase the amount of bare ground. This can be detrimental, beneficial, or a combination of both. Commonly, the dead plant material from sprayed plants breaks down and covers the soil surface, providing a protective litter layer. However, increased amounts of bare ground could result in a temporary increase in soil erosion, for example, during a high intensity rain event. The bare ground also provides a bed for the deposition of freshly produced seeds, whether these are from desirable species or from invasive species.

Also indirectly and less visibly, when invasive plant density is reduced, the effects of allelopathy on a stand of desirable plants begin to subside (Perry et al. 2005, Thorpe et al. 2009). Over time, soil organisms in the rhizosphere associated with the native plant community can begin to re-adjust and recover.

On a larger scale, indirect effects include plant community composition changes (see sections below) that can be variably beneficial or detrimental. Indirect effects are more subtle than direct effects and more difficult to measure. Fortunately, abundant research into indirect effects provides insight. The first and most immediately observable indirect effect of invasive plant control is the reduction in cover, density and vigor of the targeted plant species. Then the composition of desirable plant species begins to re-adjust over time.

The SCNF practices IWM, incorporating multiple management strategies wherever possible. This includes the combination of biological control and herbicide application. This integration, where successful biological control agents are established, can help to reduce the frequency of herbicide applications and lower use rates. Timing of herbicide applications are an important factor in allowing for continued interaction of biological control agents with their host plants (Ainsworth 2003). Based on the SCNF design criteria (Appendix J), herbicide applications are planned for times when the effects to host plants do not unduly interfere with the life cycle of the biological control agents.

Vegetation Group-Specific Effects from Herbicide Application

The following sections address specific non-target vegetation groups and the direct and indirect effects of herbicides to these groupings. Invasive plant species currently present in the SCNF have the highest potential to invade grasslands, shrublands and low elevation conifer cover types, especially sites where the soil and native vegetation has been disturbed. Grasslands and low elevation mixed evergreen shrub cover types are especially vulnerable to invasive plants due to lower annual precipitation, longer growing seasons, higher degree of human use, the lack of a forest overstory to inhibit shade-intolerant invasive plants, and the open structure and distribution of plants. For this reason, analysis is directed more toward graminoids and forbs than other vegetation groups.

Coniferous Trees

The frequency of weed invasion and rate of weed expansion in conifer plant communities often depends on disturbance: the type of disturbance, the frequency and severity of disturbance, the scope of the disturbance and the amount of time it takes an area to recover vegetatively from disturbance (Johnson et al. 2006, Zouhar et al. 2008).

Conifers as a group are not very susceptible to many herbicides, but may be variably affected based on species and age as well as the herbicide, the application rate and the application techniques used

(Appendix I). Direct effects are most common on conifer seedlings; they are most likely to experience direct contact with herbicides since they have not yet grown beyond the height of most target invasive plant species. Effects may include lethal or non-lethal damage (Appendix I). Older trees (from the sapling stage up) are much less likely to experience any direct or indirect effects because their foliage is well above the height of understory plants and their bark has thickened.

Within the project area, invasive plant infestations in conifer cover types occur in two very different settings. Moist conifer cover types occur at higher elevations with higher annual precipitation, have colder night-time temperatures, shorter growing seasons, and often have dense overstory canopies and multiple layers of understory vegetation. Most invasive plants within the SCNF are shade-intolerant, meaning that the density and vigor of invasive plants are inversely related to shading and competition from overstory trees, saplings/seedling and understory vegetation. These characteristics tend to preclude invasion by those invasive plant species that presently infest the SCNF, except along dispersal corridors and routes where conifer overstory have been cleared within the right of way of the road or trail (Parks et al. 2005, Pollnac and Rew 2013). Invasive plant infestations in these cover types occur where roads and trail corridors intersect these cover types, but generally do not extend into the conifer plant communities (USDA Forest Service SCNF NRIS database 2012). Herbicide is applied as needed along the road and trail corridor with no effects to the moist conifer cover types.

At the other end of this spectrum are the dry conifer cover types. Many of the noxious weed species infesting landscapes within SCNF readily invade ponderosa pine and the lower elevation band of Douglas-fir, particularly where these cover types have been disturbed repeatedly by road construction, timber harvest and fire. Most noxious weed infestations in the project area that occur within a conifer cover type are located in open forest stands on southerly and westerly aspects at lower elevations (USDA Forest Service SCNF NRIS database 2012).

As a result of this pattern of infestation, herbicides to control invasive plants may be applied in the understory of these dry conifer cover types, particularly along roads and trails or in logged or burned areas. Seedlings and saplings are most likely to be exposed to herbicides through ground-based broadcast application.

In the SCNF, herbicide application in conifer stands typically involves the use of the same herbicides and application rates as those used in grasslands and shrublands. SCNF managers reduce the potential for adverse effects to conifers through herbicide selection and application techniques. For example, clopyralid may be selected over picloram when applying in an understory with numerous seedlings and saplings. Applying at lower pressure and using directional application techniques reduces herbicide contact with conifer foliage. Herbicide labels provide instructions to prevent non-target damage to trees Adherence to herbicide label direction and avoiding direct application to trees reduces adverse effects to individual conifer trees.

Season of application can also mitigate damage (Gratkowski 1977 and 1978, Radosevich et al. 1980). Ponderosa pine, for example, was found not to be affected when 2,4-D was applied in the late summer after cessation of spring leader growth (Gratkowski 1977 and 1978). Likewise, Radosevich et al. (1980) found that seedlings from a number of pine and fir species and Douglas-fir were tolerant of herbicide applications when not in an active growth stage.

Indirectly, the application of herbicides to invasive plants can harm conifers, primarily the youngest age classes) through movement in the soil and root uptake, especially for herbicides that are quite mobile in the soil (Appendix I). This risk can be avoided by herbicide selection (e.g. selecting an herbicide such as clopyralid, which conifers tolerate easily), selecting the lowest effective use rates, following herbicide label direction, and minimizing herbicide application within the foliage zone of trees.

In the SCNF, direct and indirect effects are limited to individual trees (usually seedlings) or very small site-specific locations (typically <0.01 acre) and have no landscape-level effects since only small acreages in conifer cover types are sprayed and, with the exception of roadsides, spot spraying techniques are used under conifer overstory.

Deciduous Trees and Shrubs

Within the project area, these cover types are usually located in riparian areas and have abundant access to water. They are capable of high site productivity and can support an array of vegetation groups. They are highly preferred habitat by many species of wildlife and are often heavily occupied. Many invasive plant species are able to establish and spread quickly in the riparian environment. Common noxious weed species infesting deciduous plant communities include Canada thistle, leafy spurge, and houndstongue, while newer invaders such as oxeye daisy and salt cedar have been found in more recent years (USDA Forest Service SCNF NRIS database 2012).

Many native deciduous shrub and tree species are not highly susceptible to herbicide damage (Appendix I), but may be variably affected based on species and age as well as the herbicide applied, the application rate and the application techniques used. Some species, however, may be quite susceptible to the effects of herbicides on foliage and roots. Eliasson (1972) found that aspen were sensitive to the effects of 2,4-D, dicamba, and especially picloram. His study found that aspen was up to ten times as sensitive to picloram as it was to the other two herbicides. Bowes (1976) and Bowes and Spurr (1996) found that aspen, cottonwood, rose, and western snowberry could all be killed by applications of 2,4-D and picloram. The herbicide label for metsulfuron-methyl lists aspen, cottonwood, hawthorn, wild roses, and willows as all susceptible to lethal effects at moderate to high use rates. In addition, since glyphosate is a non-selective herbicide that can kill or injure living plant foliage, injury is possible when applied directly to deciduous species.

Non-target deciduous trees and shrubs most likely to be adversely affected by herbicide treatments are seedlings/saplings. Mature plants with actively growing foliage that is over sprayed with herbicide may also be injured. Direct effects to deciduous species can be mitigated through herbicide selection, use of the lowest effective rate and application technique. However, since SCNF currently uses only glyphosate and 2,4-D amine within 15 feet of water, deciduous species may unavoidably be affected by applications of these two herbicides near water.

Indirectly, the unintentional exposure of non-target vegetation such as deciduous shrubs and trees could result from some herbicides moving through the soil profile or water profile (Anderson 2007). Lethal or non-lethal injuries could result from the movement of herbicide away from the application site (Appendix I). This risk of exposure is reduced by adherence to label direction. For example, the label for metsulfuron-methyl advises that off-target movement in soil or water is possible and provides recommendations to reduce the likelihood of movement.

Direct and indirect effects are limited to individual plants or very small site-specific locations (typically <0.01 acre) and have no landscape-level effects.

Evergreen Shrubs

Evergreen shrubs include sagebrush species, rabbit brush, bitterbrush, ceanothus, mountain mahogany, and other shrub species that retain their foliage year round (similar to conifers). Landscapes with an evergreen shrub overstory are referred to as shrublands. Shrublands receive less annual precipitation than conifer cover types and often occur on sites with rocky or gravelly soils. The water table is often located deep underground, so water can be a limited resource. Topography also plays an important role in the distribution of evergreen shrubs (Burke et al. 1989).

Within the project area, these cover types usually occur in two distinct settings: sagebrush steppe at higher elevations (e.g. Pahsimeroi-Lost Zone) and mixed evergreen shrub communities located at lower elevations and on westerly or southerly aspects (e.g. Salmon Zone). Table 3-3 displays the distribution of shrublands within the project area.

Evergreen shrub species are variably susceptible to herbicide damage (Appendix I). Susceptibility depends on species, age and growth stage as well as the herbicide, the application rate and the application techniques used. Researchers and land managers have long known that some species are resistant to the effects of certain herbicides or particular use rates (Evans et al. 1981). Some species, such as mountain mahogany, are highly susceptible to herbicide injury while many sagebrush species exhibit minor effects to many of the herbicides and use rates commonly applied in the SCNF for invasive plant control. Younger age classes are more susceptible to the effects of herbicide while mature plants are usually less affected. Species that grow close to the ground are more likely to experience direct contact with herbicide than taller species.

Some of the herbicides in use for invasive plant control have the potential to damage evergreen shrubs. Direct effects range from plant mortality to various kinds of non-lethal stem and foliage damage. Appendix I displays the lethal and non-lethal effects of herbicide application to evergreen shrubs.

Of the herbicides in use in the SCNF, glyphosate and 2,4-D are most likely to impact evergreen shrubs (Appendix I). As a non-selective herbicide, glyphosate can be expected to kill living plant foliage it is deposited on when applied at rates toxic to evergreen brush species (i.e. at or above 1.5 pints per acre). Likewise, 2-4-D amine applied at rates at or above 4 pints per acre can kill evergreen foliage on which it is deposited. SCNF uses very little glyphosate and 2,4-D outside of riparian settings which greatly reduces or eliminates adverse effects of these two herbicides to evergreen shrubs.

The seedling/sapling age class of evergreen shrubs may be most likely to be adversely affected by herbicide treatments. However, mature plants with actively growing foliage that are over sprayed with herbicide may also be injured. Gratkowski (1977) found that stands of two Ceanothus species were susceptible to applications of 2,4-D. Evans and Young (1975) killed green rabbitbrush and big sagebrush stands with an aerially applied tank mix of 2,4-D and picloram.

Direct effects to evergreen shrub species can be managed through the selection of the appropriate herbicide, use rate and application technique (e.g. minimizing herbicide application over the top of evergreen shrub canopies), and timing of herbicide application. Spot herbicide applications are preferred in the SCNF wherever possible to reduce adverse effects to non-target vegetation

Indirectly, the application of herbicides to invasive plants can affect evergreen shrubs through movement in the soil and root uptake, especially for herbicides that are quite mobile in the soil (TNC Picloram Technical Bulletin 2001a). This risk can be reduced by selecting the lowest effective use rates and following herbicide label direction.

Forbs

Forbs are a diverse group of broadleaf plants that are important components of most cover types. In some cover types, forbs can comprise a major component of the plant community (Pokorny et al. 2004, Ortega and Pearson 2010) and play a major role in plant community function (Pearson and Ortega 2011). Forbs can be broadly divided into groups based on their reproductive strategies and root systems. Many early spring forbs are annual plants or corm/bulb species that reproduce by dry seed, often in capsules of various kinds. Other forbs reproduce by means of fleshy fruits or spread via rhizomes or stoloniferous root systems (e.g. strawberries). Yet other forbs are tap rooted, often with very large roots that grow deep underground (e.g. lupine or balsamroot species).

Forbs are typically the most impacted group of non-target vegetation in any herbicide application. Since most invasive plant species in the SCNF are forbs, broadleaf-selective herbicides are used, inevitably resulting in some degree of damage or mortality to non-target forbs as well (Appendix I). All herbicides used by SCNF have the potential to kill or damage native or desirable forb species. Once an invasive plant infestation has been established long enough to out-compete native forbs and become a monoculture, non-target damage to forbs is no longer a concern. In earlier stages of invasion, however, invasive plants and native or desirable forb plants are intermixed and non-target damage to forbs occurs.

Herbicides with short periods of toxicity and little residual activity, such as glyphosate and 2,4-D, generally have few direct or indirect effects on spring- and early summer-flowering species, when applied during periods when these species are dormant, such as mid to late summer and fall (Rice et al. 1997). These often include corm and bulb species, such as death camas, or rhizomatous species with fleshy roots, such as wild iris. Annual forbs that have completed their life cycle by the time herbicides like glyphosate and 2,4-D are applied are also unlikely to be affected. Jacobs and Sheley (1999) found forb density unaffected after 2,4-D applications in early June and early July on a study site in the early stages of invasive plant invasion.

Forb species are most likely to be adversely affected when exposed to herbicides while in an active growth stage (e.g. young plants or plants that are initiating growth in the spring), since plants are most susceptible to herbicide effects when they are rapidly developing (Rice et al. 1997). Many native broadleaf plants flower and set seeds in spring and summer and are dormant in fall. When plants are dormant, they are not as susceptible to herbicides (Rice and Toney 1996). Application of herbicides during the summer and fall when annual forbs have completed their life cycle and many perennial native forbs are dormant or are at low levels of physiological activity can substantially reduce adverse effects of herbicide application (Rice et al. 1997).

However, herbicide applications must be made to invasive plant infestations when they are most susceptible to the active ingredient. Many noxious weeds have vigorous periods of growth in spring and again in the fall when temperatures cool and precipitation increases.

Spring and early to mid-summer herbicide applications typically result in some degree of adverse effects to non-target forbs, particularly when using herbicides with residual activity (Rice et al. 1992,

Rice et al. 1997, Rice and Toney 1998, Rice 2000). Adverse effects have also been noted with some fall applications (Crone et al. 2009, Ortega and Pearson 2010, 2011).

A number of researchers working in Montana on the effects of herbicides to target and non-target plants have investigated the effects of picloram. Rice and his colleagues (2007, 2013b) Ortega and Pearson (2010, 2011), Ortega and Pearson (2010, 2011), Pokorny et al. 2004, and Crone et al. 2009 have all conducted multiple year studies of picloram. Picloram is a very effective herbicide commonly used to control highly aggressive noxious weed species like leafy spurge and spotted knapweed and it can remain active in the soil for one or more years (TNC Picloram Technical Bulletin 2001a).

Other herbicides used in the SCNF, such as clopyralid, have lesser degrees of soil residual activity (Dow AgroSciences 1997), but are also capable of producing adverse effects to non-target vegetation while the herbicide remains active in the soil.

The effects to forbs from herbicides with residual activity are often reported by researchers to be short-term with regard to cover or leaf area, but may have demographic effects (fecundity) of a longer, but unknown duration. In multiple-year studies from adjacent Montana, Rice and colleagues (Rice et al. 1992, Rice et al. 1997, Rice and Toney 1998, Rice 2000) found short-term effects on native forb species with applications of picloram, clopyralid or a mixture of clopyralid and 2,4-D. Picloram had the greatest impact on forb while clopyralid alone had the fewest. These studies showed that initial decreases in native forb cover recovered to pre-spraying levels within three years. Without continued control, however, spotted knapweed recovered to pre-treatment levels. Follow-up treatments showed that spotted knapweed control could be maintained without permanent adverse impacts to the forb component.

Arrowleaf balsamroot, a common dominant forb species in bunchgrass and sagebrush plant communities, has been used in a number of studies as a good representative of a native perennial forb. A recent study by Crone et al. (2009) investigated the effects to flowering, seed production and seedling recruitment in western Montana. Crone et al. (2009) found that a single application of picloram did not reduce leaf area of arrowleaf balsamroot in the short-term, however, it did reduce flowering and seed set, an effect that lasted for a period of four years. The application also greatly reduced the recruitment of new arrowleaf balsamroot plants. The picloram application in this study was broadcast by all-terrain vehicle (ATV) in the fall while arrowleaf balsamroot was dormant.

Pearson and Ortega (2010, 2011) had much the same results while also studying the effects of picloram on spotted knapweed and arrowleaf balsamroot on the Lolo National Forest over a six-year period of time. However, Pearson and Ortega also looked specifically at the initial levels of spotted knapweed infestation, finding at moderate and high levels of spotted knapweed invasion, that arrowleaf balsamroot cover was already depressed by spotted knapweed prior to treatment with herbicide. Pearson and Ortega also noted impacts to arrowleaf balsamroot from broadcast applications made in the fall.

Research from an ongoing study in the Great Basin south of the SCNF (Davis 2013, 2014) has found that imazapic applications suppress native annual forb species in terms of percent cover in the short-term. Similar to the results by researchers studying the effects of picloram and clopyralid, by years three to four post-application, forb species have recovered in the study areas.

Graminoids

Graminoids (grasses and grass-like plants such as sedges) are a component of all cover types and constitute an important plant life form in some cover types (Mueggler and Stewart 1981). The vigor, density, and seed production of graminoids play an important role in the ability of plant communities to recover from weed invasion (Sheley and Petroff 1999).

Some of the most common perennial native graminoids in the SCNF rangeland are bluebunch wheatgrass (*Pseudoroegneria spicata*), Idaho fescue (*Festuca idahoensis*), Sandberg bluegrass (*Poa secunda*), and needle and thread grass (*Hesperostipa comata*). In forest cover types, pinegrass (*Calamagrostis rubescens*) and elk sedge (*Carex geyeri*) are often common components of the plant community.

The effects of herbicides used in the SCNF on perennial graminoids are much less variable than the effects to non-target forbs. Most herbicides used by the SCNF are selective herbicides that target broadleaf invasive plants and do not affect graminoids. At application rates used in the SCNF, chlorsulfuron, clopyralid, metsulfuron, dicamba, imazapyr, picloram, and 2,4-D have little or no adverse effects on perennial graminoids (Appendix I). For example, Jacobs and Sheley (1999) found that perennial graminoids were unaffected by 2,4-D and on their study site, bluebunch wheatgrass and Idaho fescue increased in density with 2,4-D control of spotted knapweed.

The major exception to this is glyphosate (NuFarm 2011a). Glyphosate is a non-selective herbicide that can kill or damage graminoids, sometimes even at low use rates. Only 2,4-D and glyphosate can be used within 15 feet of water in the SCNF, so graminoid plants can be impacted by glyphosate applications in these locations.

Other herbicides used in the SCNF that affect graminoids are imazapic and sulfometuron-methyl. Imazapic is an herbicide often used in restoration efforts where the establishment of graminoids is an important component of restoration. Imazapic can often be applied to control broadleaf invasive plants simultaneously with seeding of many native grasses. However, imazapic also provides control of some annual grasses, such as cheatgrass, and some cool season, perennial grasses, such as Kentucky bluegrass (BASF 2011). Both of these grasses are non-native invasive species, control of which may be a management objective in some settings.

There have been reports that imazapic may injure some native grasses. One species, Sandberg bluegrass (a perennial, shallow-rooted grass), is native to the Rocky Mountain ecoregion, including the SCNF. This is a highly desirable grass for niche occupation and SCNF managers consider it important to retain Sandberg bluegrass where it occurs when considering herbicide applications. Davis (2014) reports that recent research in the Great Basin has found that while imazapic applications may cause a slight initial suppression of Sandberg bluegrass, plants recover within three to four years post-treatment.

In contrast to imazapic, sulfometuron methyl controls many annual and perennial grasses. Cheatgrass and Kentucky bluegrass are common examples of non-native invasive graminoids susceptible to sulfometuron methyl. Fescues and bromes, both of which occur as native grasses in the SCNF, are also susceptible to this herbicide. Sulfometuron methyl has not been applied in recent years in lieu of the use of imazapic.

Persistent herbicides are more likely to affect graminoids in the seedling stage than when mature. Sheley et al. (2002) found that effects to the establishment of grass seedlings from clopyralid and picloram applications depended on the application rate and the timing of the application relative to the time since the grass germinated. Herbicide applications made two or more weeks after grass was seeded, even at higher use rates, allowed successful grass establishment.

Spring applications are more likely to cause short-term damage to mature graminoids than fall applications, by temporarily reducing vigor and seed production of some grasses species (Rice and Toney 1998, Rice et al. 1997). In addition, mature grasses may be atypically affected by herbicides when physiologically stressed, such as during a drought period or insect outbreak. The effect of herbicides to non-susceptible graminoids is generally short-term (often no more than one or two growing seasons) and does not alter long-term species diversity or overall biomass (Rice and Toney 1998).

With the exceptions noted above, herbicide applications in general are beneficial to non-susceptible graminoids (Rice and Toney 1998, Ortega and Pearson 2010 and 2011). As an example, native grasses such as bluebunch wheatgrass are vulnerable to the impacts of weed invasion (Ortega and Pearson 2010 and 2011) and usually respond very positively to herbicide treatments that reduce weed density and cover. There are a number of reasons why graminoids respond so positively. They are not physiologically impacted by broadleaf herbicides, so they can respond rapidly to re-allocations of site resources (Rice and Toney 1998, Ortega and Pearson 2010, 2011). Soil and water resources are more available without competition from weeds. Allelopathic effects decline as weed density decreases. In addition, more growing spaces are made available for graminoids recruitment as weed density decreases (Rice and Toney 1998, Ortega and Pearson 2010 and 2011). In this example, since bluebunch wheatgrass is a community dominant in grassland and shrubland cover types, grass recovery in response to weed control measures assists in plant community recovery.

Grasslands are often impacted by a high degree of human uses (Parks et al. 2005). Historically, these sites were often settled early during westward expansion and continued on into the homesteading era. Land clearing for raising crops and livestock introduced early and widespread soil and vegetation disturbance. Many non-native plant species were introduced deliberately or accidentally, setting the stage for weed establishment and spread more than a century ago (Rice 1999, Parks et al. 2005).

Within the project area, grasslands are one of the more heavily invaded cover types (SCNF Corporate GIS Data), such as in the North Zone (Table 3-3). Although denoted as “grasslands”, these cover types usually host a wide variety of native forb species, some of which co-dominate with grasses (Pokorny et al. 2004). In these plant communities, the effects of herbicide vary between vegetation groups some of which are beneficial and some adverse, depending on the vegetation group. Researchers have found that herbicide applications can cause depressions in forb species richness, cover and fecundity (Rice and Toney 1996, Ortega and Pearson 2010 and 2011). Conversely, herbicide applications that control broad-leaf invasive plants allow graminoid species to increase in terms of cover and biomass as a result of decreased competition. In long-term studies, Rice and his colleagues have found that this effect tends to balance out over time. Nonetheless, it is important to recognize and ameliorate the effect.

Summary of Herbicide Effects on Plant Community Composition and Diversity

Some researchers have noted the phenomenon of secondary invasion (Pearson and Ortega 2009). For example, on dry sites (especially those subject to disturbance such as fire) where cheatgrass is well represented, there is often an increase in cheatgrass after herbicide application due to reduced competition from the broadleaf weeds (Pearson and Ortega 2009). This side effect of herbicide application is of concern to researchers and to managers since the goal of herbicide application is not only to control invasive plants, but to promote the re-establishment of desirable vegetation. Managers ameliorate secondary invasion with herbicide selection, application method, with the use of the lowest effective herbicide rate and with rehabilitation and restoration actions (e.g. seeding). Herbicides which are effective in controlling annual grasses may be added to the treatment mix when secondary invasion or increases in cheatgrass are a concern.

Desirable plant species that are tolerant to the herbicides being used often respond positively within a short time to initial herbicide applications (Rice and Toney 1998). Non-target plant species affected by herbicide in the short-term can respond to increased resources in subsequent growing seasons as the herbicide levels decline in the soil (Rice et al. 1992 and 1997, Rice and Toney 1997 and 1998). Based on these studies (Rice et al. 1992 and 1997, Rice and Toney 1997 and 1998), some of which have been monitored for more than ten years, it is expected that native forbs, a proportion of which would be killed or harmed by herbicide application, would naturally reoccupy treated areas if re-invasion by noxious weeds was inhibited and adequate reproductive potential of desirable plants were maintained or established.

However, the response of plant communities dominated by invasive plants to herbicides depends on factors such as the proportion of native and other desirable species prior to treatment (Rice and Toney 1998, Ortega and Pearson 2010). Treatment of a monoculture of an invasive species, with few desirable plants present, may not result in the proliferation of previously suppressed desirable species because the composition of desirable species could be too low to exert dominance (Sheley and Half 2006, Mazzola et al. 2010). On these highly degraded sites, additional restoration measures may be required to re-establish desirable plants (Corbin and D'Antonio 2012).

On invaded sites, it is likely that viable seeds of both desirable plants and invasive plants would remain in the soil following herbicide application (Cox and Allen 2008, Schulz 2011). On sites dominated by invasive plants, however, the highest proportion of seeds in the soil is those of invasive plant species. Therefore, it is likely that seed germination and growth would occur in proportions similar to the composition of the plant community at the time of treatment. Since many invasive plants have long seed viability, follow-up spot applications of herbicide are often required to reduce the levels of weed seeds in the soil (Schulz 2011).

Mechanical Control

The effects of mechanical control may be variably beneficial or detrimental. For example, a benefit of mechanical control is the reduction in the number of seeds produced and shed in a given year if the mechanical control takes places before seed production. Other beneficial effects of removal of weeds include an increased availability of water and nutrients that were claimed by the more competitive invasive plants (Bussan and Dyer 1999). Canopy cover of invasive plants is reduced as well, allowing desirable plants greater access to sunlight for photosynthesis.

Mechanical invasive plant control may disturb soils and increase the amount of bare ground. This can be detrimental, beneficial, or a combination of both. Commonly, the dead plant material from plants that were mechanically removed breaks down and covers the soil surface, providing a protective litter layer. However, increased amounts of bare ground could result in a temporary increase in soil erosion, for example, during a high intensity rain event. The bare ground also provides a bed for the deposition of freshly produced seeds and reduced competition for seeds already present in the soil, whether these are from desirable species or from invasive species. This is usually confined to very small areas since mechanical control is practiced only a small scale.

Detrimental effects of mechanical control include soil disturbance, churning of the seed bed (turns up viable seeds that have been buried in the soil and can create a germination event from soil-banked seed), and, potentially, very minor amounts of erosion due to soil disturbance, particularly on steeper slopes. The scale of such effects occurs only at a localized level since mechanical control is confined to small areas.

There could be a minor amount of incidental mortality of non-target plants due to proximity to target invasive plants or to occasional misidentifications, especially at the seedling stage.

The extent of use for all methods of mechanical control in the SCNF is limited and most often used in conjunction with other invasive plant control techniques. However, the SCNF considers mechanical treatment as an important invasive plant control tool, especially for controlling invasive plant species which can exhibit long distance seed dispersal, such as houndstongue, puncturevine or rush skeletonweed.

Hand Pulling, Grubbing, Hoeing

Hand pulling target invasive plants has very little direct effect on native vegetation for several reasons: (1) only extremely limited areas can be effectively treated by this method, (2) there is limited soil disturbance with hand pulling and (3) only target invasive plants are removed.

Hand pulling, grubbing and hoeing do create small areas of bare soil that will be promptly re-colonized without additional control measures if there are residual viable seeds in the soil.

A minimal amount of soil disturbance may result from hand pulling, grubbing and hoeing. The impacts of soil disturbance are limited to the immediate area around the plants that have been removed by hand pulling, grubbing or hoeing.

Grubbing and hoeing target invasive plants may also affect adjacent non-target plants due to the increased soil disturbance and the fact that some non-target plants are injured or killed since these methods are less selective than hand-pulling.

Cutting and Mowing

Cutting, mowing and other similar methods that use hand or power tools have minimal potential to disturb the soil. The goal of cutting and mowing methods is to reduce the vigor and reproductive ability of targeted plants. Depending on the target species, intermixed non-target plants could also be affected by these treatments. Timing the treatments when possible to avoid interfering with seed production phases on non-target vegetation can be used to reduce the impacts to desirable species.

Cutting of some invasive plant species, such as salt cedar which grows in a large shrub to small tree form, is a treatment that removes only stems of the target species. Unless mistakes are made in correctly identifying the target species, cutting generally has no direct non-target effects.

Torching

Torching is only used in the SCNF in focused circumstances due to the possibility of fire escaping and burning areas not intended for treatment. An example of targeted burning in the SCNF would be using a propane torch at dispersed, undeveloped camp sites to destroy viable puncturevine seeds. Soil at these sites are compacted and hardened, due to frequent use, and little vegetation is present. Due to the site setting, effects are generally limited to changes in soil morphology from the application of fire.

Rehabilitation and Restoration Practices

The beneficial direct effects of rehabilitation and restoration practices include increased cover and density of desired plant species and soil stabilization. Indirectly, rehabilitated and restored sites are more resilient to disturbance, more capable of resisting re-invasion and are able to perform the functions of healthy plant communities (e.g. improved soil water retention or quality wildlife habitat). Achievement of desired condition can be a gradual and iterative process, consisting of various stages, monitoring and response to the feedback provided by monitoring site recovery.

Perhaps the most visually noticeable direct effect of active restoration is that period between control and establishment of desirable vegetation, leaving a site looking barren. There may be little or no desirable vegetation remaining on the site and the soil surface may be bare. Bare soil is generally vulnerable to disturbance and erosion, whether naturally through wind and water, or through human activity.

In the case of assisted restoration, some actions may result in soil disturbance (e.g. seeding using an ATV or pickup-mounted seeder). Seeding by hand or using an ATV on gentle terrain does not result in a measurable amount of soil disturbance. However, depending on the site and potential severe weather events, the use of motor vehicles on steeper slopes (e.g. greater than 25% slope) could potentially result in a noticeable amount of soil disturbance and even some degree of erosion, such as rilling (very shallow channels of overland water flow that carry sediment downslope until deposited against an obstacle).

Seedbed preparation requires some degree of soil disturbance (Goodwin et al. 2006). When a site to be restored has compacted soil or few suitable microsites are available for the establishment of seeds, the site may be scarified with a hand rake or a harrow. A harrow may be pulled with a pickup, an ATV or even teams of mules. Areas of bare soil, particularly on steeper slopes, could experience soil erosion in the event of heavy precipitation such as a high intensity rainstorm or a rain on snow event before desirable vegetation has been re-established. Design criteria (Appendix J) are used to lessen the concerns of water movement and soil erosion.

The restoration effort could fail partially or altogether, with a loss of invested funding and time. Delayed success could yield increased soil erosion or poor site productivity. This is most likely to occur on highly degraded sites, which are the very sites most likely to require assisted restoration. For example, restoration may fail because seeds did not germinate or plant mortality after seeding or planting was high. Research and the cumulative practical experience of land managers have

resulted in a body of knowledge for improving the likelihood of successful restoration (Monson et al. 2004, Goodwin et al. 2006, Sheley and Half 2006). These include measures such as control of invasive plants to reduce their competitive effects, selecting plant materials adapted to the site being restored (e.g. using plant plugs rather than seed in riparian areas), seed bed preparation where needed, increasing seeding rates, adding native forbs to grass seed mixes (to occupy all vacant niches possible and to improve soil fertility by including nitrogen-fixers), using primed seed or coated seed, and mulching when needed. These are a few examples of the many techniques available to managers to ensure a successful restoration outcome.

Forest Service policy recognizes that there are situations in which non-native plants may be the best choice for restoration (FSM 2070). For example, in an emergency such as when dealing with highly erodible soil after a fire, managers may seed with a non-native, sterile, short-term, non-persistent cereal grain (e.g. rye) to provide soil stabilization, protect water quality and help prevent or slow the establishment of invasive plants while native vegetation recovers from the effects of fire. Another example is permanently and highly altered sites dominated by invasive plants that may require interim seedings with non-native plants to initiate site recovery. Managers have to weigh the trade-offs in using non-native plants since there is potential for competition with native plants (FSM 2070 2008).

Several indirect effects are not visually noticeable. When locally sourced material is not available or is not available when needed, commercial sources must be used. Plant materials obtained from distant locations may not be well-adapted to local site conditions and perform poorly (USDA Forest Service 2006a and 2006b). Commercially-obtained plant materials could potentially introduce new plant genetics. Forest Service manual direction requires that managers use genetically appropriate plant materials in restoration activities (FSM 2070 2008).

The Forest Service requires the use of weed seed-free seed (USDA FS 2011a); however, using commercially grown seed is never completely risk-free, since it could contain a small amount of invasive plant seeds. A commercial seed mix contaminated with non-native invasive plant seeds could introduce new invasive plants to the project area, negating the goals and objectives of restoration. Although this risk cannot be completely eliminated, there are design criteria that address this concern (Appendix J). State and federal law also address this concern through requirements for purity testing and seed packaging labels (Hoag et al. 2001).

Recent research shows that remnant native plants that have persisted even in heavily weed-infested areas may be of crucial importance in post-weed control recovery (Strauss et al. 2006, Leger 2008). Leger (2008) notes that remnant native plants may possess genetically adaptive traits that have enabled them to survive in these infested environments while other plants without the adaptive trait did not survive the invasion process. Protection of remnant desirable plants may therefore contribute to more rapid recovery of a functional, desired plant community in formerly weed-infested areas.

The importance of seed banks of native species is also of importance in re-establishing desirable plant communities since viable seed may yet be present in the soil even though no plants of native species contained in the seedbank may have survived weed invasion (Cox and Allen 2008). Native plants can begin to re-establish from seeds dormant in soil as well as seed dispersal from adjacent uninvaded sites.

While there is a range of measures that the SCNF may take to accomplish site recovery, the extent of use for all rehabilitation and active restoration measures in the SCNF is limited and is implemented as part of the IWM program. As part of IWM, the SCNF prefers natural site recovery with native plant species whenever possible. However, active measures may be taken when a degraded site is not capable of recovery without intervention.

Cumulative Effects

Biological Control

The Frank Church-River of No Return Wilderness Area (FC-RORN) is located to the west of the project area. Part of the FC-RONR Wilderness is managed by the SCNF and the invasive plant management program in the FC-RONR Wilderness is very similar to that of the SCNF. Managers have employed biological control agents primarily for spotted knapweed and rush skeletonweed control in the FC-RONR Wilderness. With one exception, the biological control agents released in the FC-RONR Wilderness have been insects. The only pathogen released to date has been rush skeletonweed rust (*Puccinia chondrillina*).

Rush skeletonweed is spreading rapidly in the FC-RONR Wilderness and the primary management tool available is biological control. The *Puccinia* rust has had little to no apparent effect in reducing plant vigor, seed production or plant density. Of the biological control agents released in rush skeletonweed infestations, only one (a gall mite that attacks flower heads) has had any effect in controlling rush skeletonweed. Although this agent has successfully established and is naturally dispersing, the reduction in rush skeletonweed seed production has been too minor for the gall mite to provide effective control. As a result, rush skeletonweed is steadily expanding eastward into the project area from the FC-RONR wilderness area (USDA Forest Service SCNF NRIS 2012). Since the FC-RONR Wilderness area practices very little active control of rush skeletonweed, SCNF managers and managers of other land ownerships have been actively collaborating to create containment boundaries in an effort to slow the spread of this noxious weed species from the wilderness area.

In addition to the use of biological control agents, other federal, state, county and private entities in central Idaho pursue active biological control programs. Like the Forest Service, other government agencies follow federal APHIS standards for the collection and release of biological control agents. However, they may release different agents than the SCNF, perhaps because they have invasive plants that do not presently occur in the SCNF or because they are interested in evaluating the potential of new or different agents on weed infestations on lands that they manage. Data is not available for biological control agents released by private landowners, although private landowners would be likely to obtain agents from the same sources as the federal, state and county governments.

Cumulatively, multiple releases by different entities in Butte, Custer, and Lemhi counties have the effect of distributing biological control agents over a broader area. This leads to a better metapopulation structure since the agents are widely distributed in appropriate habitat and are close enough together to fill in the gaps between release sites through natural dispersal.

There are infestations of invasive plants in Butte, Custer or Lemhi Counties that do not presently occur in the SCNF (e.g. scotch thistle) and agents may be released for control of these invasive species. Since some biological control agents are capable of self-dispersal, infestations of these

invasive plant species which become established in the SCNF may include naturally dispersing biological.

With regard to common human activities in the project area there are no cumulative effects related to biological control. Likewise, there are no present and foreseeable actions in the project area (Appendix H) that cumulatively interact with biological control efforts under the Current Action.

Herbicide Control

For the purpose of this analysis, the baseline for consideration of cumulative effects of herbicide control is the existing condition of invasive plants in Butte, Custer, and Lemhi counties . Activities considered are those associated with ongoing invasive plant management by other entities in conjunction with the SCNF Current Action management activities, human activities within the project area and present and foreseeable human uses of natural resources in the project area (Appendix H).

Invasive plant management activities are ongoing in the FC-RONR Wilderness to the west of the project area. The invasive plant management program in the FC-RONR Wilderness is very similar to weed management in the project area. All of the essential program elements, such as detection and control using herbicides, are present. Table 3-6 displays the three year-average of herbicide applications in that portion of the FC-RONR Wilderness managed by the SCNF.

Table 3-6: 3-Year Average (2010-2012) Annual Herbicide Output by FC-RONR Wilderness

2010	2011	2012	3-Year Average
54.8 acres	222.7 acres	31.9 acres	103.2 acres

The SCNF portion of the FC-RONR Wilderness is less infested than the project area, with some exceptions. For example, rush skeletonweed, a wind-dispersed species, is spreading rapidly in the Middle Fork of the Salmon River corridor (SCNF Corporate GIS Data). Large infestations and very remote infestations in inaccessible terrain mean that managers must rely on biological control in some infested areas of the FC-RONR Wilderness. Since there are fewer acres of invasive plants and because much of the control actions are based on the use of biological control agents, there is correspondingly less herbicide application in the FC-RONR Wilderness. Since the FC-RONR Wilderness is a separate management entity, there is no overlap between the FC-RONR Wilderness and the project area. However, there are a number of watersheds split by the FC-RONR Wilderness and the SCNF boundary line. In these cases, management activities may occur in both the FC-RONR Wilderness and the SCNF, and within the same watershed. Since the total annual herbicide output across the FC-RONR Wilderness is very low (approximately 100 acres or less), the cumulative herbicide output total in these watersheds remains small (Appendix H).

The SCNF and the FC-RONR Wilderness invasive plant management programs use most of the same herbicides (Table 2-2). The primary difference between the FC-RONR Wilderness and the Current Action is that newer herbicides (e.g. aminopyralid) may be used in the wilderness once SERA risk assessments and consultation with regulatory agencies is completed. Aminopyralid (SERA 2007a) is a broad spectrum, soil residual herbicide that can be likened to picloram. However, the use rates for aminopyralid are much lower and it is often less toxic to non-target vegetation in a number of plant families. Aminopyralid can also be used close to water whereas there is currently a 50-foot setback from the water's edge for picloram. For these reasons, managers for the FC-RONR-Wilderness have begun to use aminopyralid rather than picloram. Like the SCNF, the FC-RONR Wilderness invasive

plant management program uses little 2,4-D and glyphosate. Dicamba has not been used in recent years.

Other invasive plant herbicide control activities occur and will continue to occur adjacent to or near the project area. Appendix H displays the 2010 through 2012 three year-average herbicide application by the Butte, Custer and Lemhi County invasive plant management programs and the Bureau of Land Management (BLM) within the boundaries of these three counties. These herbicide applications are implemented by Idaho state professionally licensed herbicide applicators using EPA-registered herbicides per label directions. Butte, Custer, and Lemhi Counties use a much broader range of herbicides than those used in the SCNF (Appendix H) and they apply herbicides to a wider range of sites than the SCNF.

Butte, Custer, and Lemhi Counties consist primarily of federally administered land with small amounts of State and private land. Table 3-7 (Idaho Association of Counties 2010) displays the division.

Table 3-7: Land Ownership in Butte, Custer, and Lemhi Counties

County	Total Acres	Percent Federally Administered Lands	Percent Private Land	Percent State Land
Butte	1,429,056	86.1%	12.8%	0.9%
Custer	3,152,384	93.2%	5.0%	1.7%
Lemhi	2,921,152	90.7%	8.0%	1.3%

Of the three counties, Butte County has the highest output of annual average herbicide application and also the highest amount of non-federal land (13.9%). Custer County has an average herbicide output of about 1,125 acres across the least amount of non-federal land (6.8%). Lemhi County has the lowest amount of average annual herbicide output distributed across 9.3% non-federal land. Table 3-8 displays the three-year average herbicide output from Butte, Custer and Lemhi Counties from the years 2010 through 2012.

Table 3-8: 3-Year Average (2010-2012) Annual Herbicide Treatment Acres in Butte, Custer and Lemhi Counties

Year	Butte	Custer	Lemhi
2010	2,252 acres	1,129 acres	1,346 acres
2011	1,773 acres	1,047 acres	357 acres
2012	2,023 acres	1,193 acres	998 acres
3-Yr Average	2,016 acres	1,123 acres	900 acres

As a comparison, Butte, Custer and Lemhi Counties together manage far less acreage than the SCNF (a combined total of 684,668 acres compared to 1.3 million acres. The average annual herbicide output of the three counties is about 4,040 acres compared to the SCNF's annual output of approximately 1,350 acres.

The BLM is the other federal agency responsible for the management of large amounts of public land within the boundaries of Butte, Custer and Lemhi Counties. Table 3-9 displays the three-year average herbicide output by the BLM Challis and Salmon Field Offices (FOs) from the years 2010 through 2012.

Table 3-9: 3-Year Average (2010-2012) Annual Herbicide Output by Challis and Salmon BLM Field Offices

Year	Challis BLM	Salmon BLM
2010	75 acres	490 acres
2011	109 acres	281 acres
2012	46 acres	509 acres
3-Yr Average	77 acres	427 acres

The Challis and Salmon FOs invasive plant management programs are very similar to the SCNF. The Challis and Salmon FOs of the BLM are approved to use much the same herbicides as the SCNF. For the years 2010 through 2012, the two FOs used eight herbicides (2,4-D, chlorsulfuron, clopyralid, glyphosate, imazapic, metsulfuron-methyl, picloram and triclopyr), all of which may be used by the SCNF. In contrast to the SCNF, however, the Challis and Salmon FOs use much more 2,4-D and glyphosate.

The extent of herbicide applications for invasive plant management on lands adjacent to or near the SCNF cannot be quantified in all instances; as only some of these activities are known to the Forest Service and are not required to be reported to the state or other government agencies. Since other governmental invasive plant management entities do not collect usage data to the extent that the SCNF does or in the same manner, comparison can, in some instances, be difficult. Moreover, the State of Idaho does not require that private applicators collect application data to the same degree as professional applicators. The SCNF does not know the extent of herbicide use by the private sector in Butte, Custer, and Lemhi Counties.

Additionally, management of these areas may change over the 10 to 15-year timeframe of this project. Currently, county road right-of-ways and State highway right-of-ways are treated with herbicides in Butte, Custer and Lemhi Counties. The Bureau of Land Management, the Idaho Department of Fish and Game, Idaho Department of Transportation and Butte, Custer, and Lemhi Counties all engage in invasive plant control measures, as do many private landowners, particularly ranchers and other agricultural producers. It is expected that invasive plant control efforts including aerial and ground application of herbicides will continue on State-owned, privately-owned, and public lands surrounding the SCNF.

Most herbicide applications on private land occur on sites that no longer contain native plant communities. Typical sites for herbicide application would include hay fields, stock pastures, stack yards, or corrals. There are no cumulative effects to native plant communities from these applications. They do not occur on National Forest System lands and do not take place in native plant communities.

Consideration of adverse cumulative effects of herbicide application to desired and native plants on lands in and around the SCNF are very similar to those of direct and indirect effects the primary difference is that of scale. Although treated acreage across the landscape is additive, there is no spatial overlap; the BLM and County herbicide treatments displayed in this discussion of cumulative effects do not occur on National Forest System lands.

Invasive plants were originally introduced into the United States and, by extension, into the project area by humans, whether deliberately or unintentionally. Common human activities in the SCNF cumulatively continue to introduce and spread invasive plants throughout the project area. Human activities and enjoyment of public land cannot be terminated even though they are a continual

source of invasive plant introduction, establishment and spread. Note that this highlights the importance of prevention, including weed awareness and education, as a component of invasive plant management.

Likewise, present and foreseeable actions (Appendix H) also contribute cumulatively to the introduction, establishment and spread of invasive plants as humans engage in legitimate and permitted use of natural resources. These cumulative effects are both temporal and spatial, with recurring and frequent introduction events spread across the project area wherever activities occur. The effects may result when a single viable invasive plant seed is dropped from a motor vehicle alongside a road, for example, or from large scale vegetation and soil disturbance that results from projects such as minerals exploration or timber harvest. Natural events, such as drought, high intensity storms or wildfire, can exacerbate the cumulative effects of human uses of natural resources in the project area. The Forest Service responds to the need to alleviate these impacts through the use of prevention measures and contract and permit clauses intended to reduce the risk of invasive plant introduction.

Mechanical Control

Other federal, state, county and private entities in central Idaho implement the same mechanical control methods as the SCNF. Since mechanical control methods are practiced on such small and isolated acreages, there is little likelihood of adverse cumulative effects.

There are, however, beneficial cumulative effects that accrue from the various invasive plant management organizations implementing similar mechanical control methods on the same invasive plant species. For example, it is a practice in Lemhi County to mechanically remove all salt cedars. The cumulative effects of these activities as they are currently practiced would likely continue at the same spatial scale unless other federal, state, county or private entities began to practice mechanical control methods that are not currently used.

With regard to common human activities in the project area there are no cumulative effects related to mechanical control activities.

There are potential cumulative effects associated with present and foreseeable actions in the project area (Appendix H) which could interact with mechanical control efforts under the Current Action. These interactions would be minor and limited to actions that contribute to soil disturbance in the same places where mechanical control is practiced. Since program managers in the various SCNF natural resources routinely communicate and coordinate ground-disturbing activities, these cumulative effects would be alleviated by design criteria developed for any particular project that created soil disturbance.

Conclusion

There would be no cumulative adverse effects to vegetation resources resulting from Forest Service and other jurisdictions' weed control activities, all of which follow applicable state and federal requirements. Beneficial effects of weed control accrue at both the site level and at the plant community and landscape level. These include improved plant community composition and ecosystem resilience. These beneficial effects would not only be realized within the project area, but would also benefit lands beyond the project area by reducing the movement of invasive plant

reproductive propagules or seeds from FS lands. In conclusion, the effects to vegetation resources as a result of weed control activities result in short-term impacts, but long-term benefits.

Continued implementation of the Current Action would provide a reduction in the density of existing invasive plant populations within currently infested native plant communities and a somewhat reduced spread of invasive plant seed from these populations to un-infested plant communities in and around the SCNF, albeit at a substantially reduced rate from Alternative 3. Ongoing invasive plant control in existing infestations would reduce density and seed production, provide continued reduction of the seed bank and allow gradual re-establishment of desired plant species.

Since invasive plant cover is generally low and spot treatment is the commonly used herbicide application method, impacts from control of invasive plants to native plant communities are minor with regard to species' abundance, diversity and distribution in the SCNF. Although non-target vegetation can be affected by invasive plant control activities, there is greater potential for adverse effects to structure and function of native plant communities if invasive plants are not controlled. The benefits of managing invasive plants are numerous, including the conservation of native plants, and community diversity, structure and function. This, in turn, benefits organisms dependent on the habitats provided by a plant community.

The Current Action does not address the use of herbicides including EPA identified reduce risk pesticides such as aminopyralid other than those which were approved for use ten or more years ago. The SCNF would not be able to use new herbicides with lower use rates and lower toxicity than the older herbicides currently in use. The continued use of higher toxicity herbicides results in greater potential for impacts to non-target vegetation.

The Current Action does not permit the use of aerial herbicide applications which are: (1) much less expensive on a per-acre basis than ground-based operations, (2) capable of treating areas inaccessible by foot or ground vehicles, 3) capable of treating larger areas in a shorter period of time than ground-based operations, and (4) provides for landscape-level plant community and restoration. Aerial herbicide application would not be used on infestations that can currently only be treated with biological control agents due to lack of access or availability of water. There would be a continued expansion of these infestations.

Moreover, the Current Action alternative does not address the management of aquatic invasive plant species other than prevention measures such as encouraging boaters to clean, drain and dry their boating and watercraft equipment. Infestations of aquatic invasive plants that could become established in the SCNF cannot be managed for eradication at present. Without the ability to respond to these introductions, aquatic invaders would establish and spread in susceptible locations. Impacts to aquatic habitats including habitats for ESA listed fish species could significantly impact the health and function of aquatic ecosystems.

The Current Action alternative complies with federal legal requirements. However, the Current Action is lacking with respect to Forest Service national and regional direction on the management of invasive plants species. Specifically, the Current Action does not provide:

- an adaptive, integrated program that incorporates all nationally recognized elements of invasive plant management
- the ability to control invasive plant infestations with aerial herbicide applications

- control of aquatic invasive plant species, should they invade and establish in the SCNF, and approval to use herbicides to control aquatic invasive species
- does not provide a mechanism for adopting new herbicides that are less toxic and potentially more effective than herbicides currently in use

Invasive plant treatments implemented in accordance with the Current Action would have relatively short-lived detrimental effects and long-term beneficial effects. Detrimental effects to non-target plant species would be minimized through the implementation of the design criteria displayed in Appendix J.

3.2.6.4. Alternative 3-Proposed Action

Introduction

A total of 2,000 acres could be treated annually with biological control agents divided among 400 individual releases (Table 3-5). This number represents a five-fold increase over the Current Action, which could be achieved over the 10 to 15-year lifespan of the project. Herbicide application of up to 16,000 treated acres per year would be approved (an increase of approximately 38 percent over current management), with this acreage potentially divided equally between ground-based application and aerial application, based on funding and treatment priorities. For ground-based herbicide application, this would amount to approximately 3,200 applied acres annually (Table 2-7) since the preferred method for most ground-based herbicide applications would remain spot application. For aerial application, applied acres would be the same as treated acres, since an aerial application would necessarily be a broadcast application. Seven herbicides could potentially be used for aerial application, as shown in Table 2-10Table 2-5: Maximum Wind Speeds and Associated Applications

This alternative would also approve herbicide application for aquatic invasive plant control, although no acreage is assigned, as there are presently no known infestations of aquatic invasive plants in the SCNF.

Manual and/or mechanical invasive plant control could be implemented across 2,000 treated acres annually. Although this is a very large increase over current manually and/or mechanically treated areas, it is intended to provide a basis for analysis and flexibility over the 10 to 15-year lifespan of the project.

Three additional herbicides would be approved for use (Table 2-10), including one herbicide which could be used for ground-based and aerial applications and two herbicides for aquatic application, if needed.

Direct and Indirect Effects

Biological Control

The direct and indirect effects of biological control as implemented by Alternative 3 would be the same as those disclosed under Alternative 2, Current Action, except that the number of releases made annually could potentially increase over the 10 to 15-year lifespan of the project.

Mechanical Control

The direct and indirect effects of mechanical control as implemented by Alternative 3 would be the same as those disclosed under Alternative 2, Proposed Action.

Herbicide Control

The direct and indirect effects of herbicide control as implemented by Alternative 3 would be similar to those disclosed under Alternative 2, Current Action, with several exceptions. These exceptions include:

- The addition of the use of three herbicides: aminopyralid, imazapyr and imazamox.
- The use of aerial herbicide application using helicopters.
- Establishes parameters in treated and applied acres.
- Treatment of aquatic invasive plants when and where they are found in SCNF waters.

Herbicide Summaries

Aminopyralid

Aminopyralid is a low toxicity herbicide, approved by the EPA in the reduced risk pesticide program, which, that provides excellent control of broadleaf weed species in a number of different plant families (Dow Agrosciences 2005, SERA 2007a). It is in the same class of herbicides as picloram and clopyralid and is most active on broadleaf plants in the sunflower and pea families. It is already in use in the FC-RONR Wilderness and has provided excellent control of weed species such as spotted knapweed (Rice 2013) and rush skeletonweed (Franklin County Noxious Weed Control Board, undated). Aminopyralid is a low use rate herbicide and is of low toxicity to a number of different vegetation groups, including forbs in some plant families (e.g. borage and mustard families).

Many conifers and evergreen shrubs, deciduous trees and shrubs, and graminoid species are tolerant to moderately tolerant of aminopyralid (i.e. exhibiting no injury or only temporary, minor injury when exposed to aminopyralid (Dow AgroSciences 2013). Because of its low toxicity and environmental fate profile, aminopyralid can be used in riparian areas and close to water, where picloram and clopyralid cannot be used.

Aminopyralid has limited activity on woody species; aminopyralid may be sprayed as a spot application under the canopy of conifers and deciduous species with minimal injury in many cases (Dow AgroSciences 2013). Mature trees are least likely to be affected while seedlings and saplings are more likely to be injured. However, Wallace et al. (2012) studied the effects of a spring time aminopyralid application beneath ponderosa pine saplings, a conifer species for which the aminopyralid label recommends caution when treating below the canopy. These researchers found minor injury from lower aminopyralid use rates to young trees in active growth stages (although high use rates caused greater injury) and recommended the use of aminopyralid over picloram in stands of young ponderosa pine.

Aspen, cottonwood, and willows are all tolerant of aminopyralid (Dow AgroSciences 2013), making aminopyralid a good choice for treatment in these cover types. Some native deciduous shrub species in the rose family are susceptible to aminopyralid, such as wild rose, while other members of the family, such as chokecherry, are moderately tolerant (Halstvedt et al. 2012). Spot applications

made at lower use rates would reduce the likelihood of injury to susceptible deciduous species like wild roses.

As a group, evergreen shrub species exhibit tolerance to aminopyralid. Ongoing field research at a variety of study sites in the western US shows that sagebrush shrub species are tolerant of aminopyralid (Halstvedt et al. 2012). Other evergreen shrubs such as ceanothus are also tolerant of aminopyralid.

Grass species are very tolerant to aminopyralid and can be planted at the same time or the spring following an aminopyralid application(Dow AgroSciences 2013). Most grass seedlings have sufficiently developed within 45 to 60 days after emerging to be tolerant of aminopyralid applications. As with other broadleaf herbicides, aminopyralid has been shown to increase graminoid abundance and cover (Samuel and Lym 2008).

As a broadleaf herbicide, aminopyralid has the potential to affect many different forb species. Since aminopyralid was registered for use in 2005, a number of researchers have investigated the effects of aminopyralid to native forbs, particularly in natural settings, across the United States. Studies from the central and western US are helpful to this analysis in determining the effects of aminopyralid applications to forbs native to the SCNF. As an example, Halstvedt et al. (2010) established ten study sites in four states, including sites in western Montana. These researchers determined individual tolerance rankings for 98 native forb species and 19 native shrub species representing 29 plant families. These researchers found that more than 50 percent of the species studied were moderately tolerant to tolerant to aminopyralid. These researchers also found that some native forb members of the sunflower family, such as arrowleaf balsamroot, displayed recovery two years after treatment although they exhibited herbicide injury at the time of application (Halstvedt et al. 2012).

A long-term study undertaken by Rice (2013) into the effects of spring-time (when plants are most susceptible to herbicide) aminopyralid application to native forbs, has several aspects pertinent to this analysis. Rice has evaluated the efficacy of aminopyralid compared to picloram treatments and found that one aminopyralid application provided excellent spotted knapweed control out to four years post-application. The data confirms that aminopyralid is a suitable substitute for picloram and indicates that aminopyralid provides good residual control, thus increasing the re-treatment interval. This study has also examined the tolerance of native plant species to aminopyralid and provides an indication of recovery time for plant community components after herbicide application.

Halstvedt and Rice (2009) also evaluated aminopyralid plant tolerance/susceptibility and then compared the results to picloram and clopyralid. They found that native forb injuries from aminopyralid were greater than clopyralid, but less than those associated with picloram. As with picloram, clopyralid and other similar herbicides, field studies indicate that even for tolerant native forb species, aminopyralid applications can reduce foliar cover and seed production in the short-term (Almquist and Lym 2010). Researchers have found that aminopyralid is injurious to many members of the sunflower, pea, evening primrose and rose families (Duncan et al. 2008, Almquist and Lym 2010). Some forb species have been shown to be susceptible to injury, but are not killed by aminopyralid (Mickelsonn and Lym 2013). As with other herbicides, the timing of aminopyralid applications can be important (Halstvedt et al. 2011). Among susceptible forbs, most species studied had recovered pre-treatment foliar cover within two years post-treatment. Studies to date

indicate that overall aminopyralid effects to native forbs are short-term, with the exception of a few very species that are highly susceptible (Samuel and Lym 2008, Halstvedt et al. 2010, Mickelsonn and Lym 2013).

Imazamox

Imazamox is labeled for aquatic applications (SERA 2010) and the use of imazamox is proposed to treat aquatic invasive plant species in or at the margin of water bodies. Imazamox is active on submersed, emerged and floating monocot aquatic plants (BASF 2009). It works by inhibiting a plant enzyme called acetolactate synthase (ALS) which regulates the production of essential amino acids in plants. When ALS is inhibited, plants die. The efficacy and selectivity of imazamox on aquatic vegetation is determined by the use rate and by the method of application.

There would be no effects to conifers, deciduous trees and shrubs, evergreen shrubs, and terrestrial grasses and forbs resulting from imazamox applications. Imazamox would be used by the SCNF only for applications to water and at the water's edge.

Native macrophytes could be severely injured or killed by imazamox, if present and growing interspersed with target aquatic invasive plants (SERA 2010). Since the emphasis for aquatic invasive plants is one of early detection and rapid response, direct and indirect effects would be limited to very small, site-specific locations. New infestations of aquatic invasive plants would likely be less than 0.1 acre in size. At this scale, applications of imazamox would have no landscape-level effects to populations of native macrophytes.

Imazapyr

Imazapyr is labeled for aquatic applications (SERA 2011b) and the SCNF is proposing the use of imazapyr primarily for treating emergent aquatic invasive plant species in and around water. Imazapyr is recognized as being a very effective herbicide for an array of emergent aquatic invasive plants and weed species that grow right along the water's edge, often with their roots in the water (Tu et al. 2001). These include species such as salt cedar and knotweeds that invade riparian areas. Imazapyr is toxic to susceptible plants at low concentrations (Trevathan 2002c).

Imazapyr is a broad-spectrum herbicide that is similar to glyphosate in terms of its non-selectivity. In addition to aquatic macrophytes, it is toxic to many annual and perennial grass species and broadleaf species as well as many brush and vine species (BASF 2013). Those plant species that are resistant to imazapyr apparently metabolize it to an immobile form that cannot be translocated to the meristematic tissues (Shaner and Mallipudi 1991). In addition, when imazapyr is applied at high rates, it can result in season-long soil activity, providing residual control of germinating seeds.

Conifers are one of the few vegetation groups that exhibit some degree of tolerance to imazapyr. Imazapyr is commonly used for forestry site preparation and weeding in conifer plantations (BASF 2012). As with most herbicides, seedlings and saplings are more likely to be affected than mature trees. Trees that are under stress from drought, disease or injury are more likely to be affected by imazapyr. Some imazapyr injuries to tolerant conifers may be transient followed by rapid recovery while injuries to less tolerant species could be severe. Imazapyr labels provide instructions such as application method, the use of surfactants, season of application and use rates to minimize the risk of injury to conifers from imazapyr. The SCNF applications of imazapyr would be intended for aquatic applications and waterline applications made to weed species that grow with their roots in

the water. The likelihood of direct or indirect effects to conifers resulting from the use of imazapyr is very unlikely.

Many deciduous tree and shrub species can be harmed by imazapyr, particularly at medium to high use rates. Herbicide labels instruct applicators to avoid contact with foliage of non-target trees and shrubs as well as the soil in which they are rooted. Since the root zone of trees and shrubs can extend well beyond the drip line, applications made along the margins of water bodies must be undertaken with care in areas where there are deciduous trees and shrubs (BASF 2012). Indirectly, however, shoreline plants with roots that extend into water bodies treated with imazapyr will generally not be affected (BASF 2012). Applications of imazapyr would be intended for aquatic applications and waterline applications made to weed species that grow with their roots in the water. For example, imazapyr could be applied to invasive knotweeds, which is a new invader in the SCNF, or to flowering rush, which is on the SCNF Watch List (Appendix A). Therefore, individual native deciduous trees and shrubs could be affected by imazapyr applications made along the margins of water bodies (although not when aquatic applications are made). Impacts can largely be eliminated by adherence to label directions, applying the lowest effective rate and proper choice of application method. Applying by wicking or rolling, rather than spraying, provides for very precise applications of imazapyr to target plant foliage only. This avoids unintentional overspray on to non-target vegetation and soil. These measures would manage the risk of effects to deciduous trees and shrubs.

In general, evergreen shrub species are tolerant of imazapyr. Applications of imazapyr would be intended for aquatic applications and waterline applications made to weed species that grow with their roots in the water. Evergreen shrub species native to the SCNF do not grow in the settings intended for imazapyr applications. The likelihood of direct or indirect effects to evergreen shrubs resulting from the use of imazapyr is very unlikely.

Imazapyr is toxic to many graminoid species and, in general, should be considered injurious or potentially lethal to desirable and native grass species. The use rate, season of application, type of surfactant used and use of imazapyr in tank mixes with other herbicides all affect the degree of injury to graminoids (BASF 2012). Graminoid plants under stress from drought, disease, insects or temperature extremes are more likely to experience mortality or injury (BASF 2012). Non-lethal effects may include chlorosis, stunting, loss of vigor and loss of seed production. Applications of imazapyr would be intended for aquatic applications and waterline applications made to invasive plant species that grow with their roots in the water. The risk of damage to non-target graminoids can be managed by adherence to label direction, applying with the lowest effective use rate, and using wicking or rolling techniques to provide very precise applications of imazapyr to target plant foliage only.

Imazapyr should be considered injurious or lethal to desired and native broadleaf forb species. Applications of imazapyr would be predominantly be used for aquatic applications and waterline applications made to invasive plant species that grow with their roots in the water. Therefore, individual plants and small groups of non-target forbs could be damaged or killed by imazapyr applications made along the margins of water bodies.

In aquatic settings, imazapyr has little or no toxicity to submersed aquatic plants (BASF 2012). It must be applied to emergent vegetation. Native macrophytes that grow submersed in water would not be affected by imazapyr. Native macrophytes that grow emerged from the water, however,

could be affected by imazapyr applications made to non-native invasive aquatic plants. At infested sites, native macrophytic plants could be severely injured or killed by imazapyr, if present and growing interspersed with target invasive plants. Since the emphasis for aquatic invasive plants is one of early detection and rapid response, direct and indirect effects would be limited to very small, site-specific locations. New infestations of aquatic invasive plants would likely be less than 0.1 acre in size. At this scale, applications of imazapyr would have no landscape-level effects to populations of native macrophytes.

Aerial Herbicide Application

The ability to use aerial application would help improve invasive plant control efforts in the project area for infestations that are currently uncontrolled or poorly controlled. Treatment limitations (e.g. topography, slope, lack of water, remote sites, and associated high treatment costs) would be easier to manage with aerial application as an approved tool. Aerial application would provide integrated management on sites where there are no or few invasive plant control options currently available due to these treatment limitations. This is a particularly important consideration for invasive plant species for which there are no biological control agents available or for which available agents have not been effective in providing weed control. Aerial application would greatly reduce treatment costs on areas that are currently prohibitively expensive due to site location, topography, and long distances to water.

Aircraft have been widely used as a land management tool for decades. Aerial application of herbicides started primarily in agriculture, but as aircraft and application equipment improved, its use expanded into natural resource management. The use of aircraft in natural resource management includes many activities, such as the control of detrimental insects, weeds and diseases or in restoration projects requiring fertilization and seeding. The need to reach large expanses of remote, inaccessible terrain and the high cost of manual, ground-based labor dictate that many of these of these activities are conducted from the air (Kilroy et al. 2003).

Currently ground-based application of herbicides is performed utilizing both spot and broadcast application techniques with design criteria incorporated to manage the risks associated with the application of herbicides. The aerial application of herbicides is no different. It is proposed to utilize helicopters to perform broadcast applications of herbicides. The design criteria were developed to minimize the risks associated with the application of herbicides by air in addition to those for general herbicide application. The design criteria for both general herbicide application and aerial application of herbicides can be found in Appendix J. For air-based projects, the SCNF intends to contract to professional businesses with experience in aerial application of herbicides in natural areas. Contract specifications would include these design criteria for general herbicide application and aerial herbicide application.

Although aviation is an inherently dangerous activity, risks can be minimized by following operating and safety guidelines. All aerial herbicide application operations would comply with the applicable provisions of the SCNF Aviation Plan (USDA Forest Service SCNF 2014), and the Interagency Helicopter Operations Guide (National Wildfire Coordinating Group 2013). . In addition to safety concerns, the other aspects of herbicide application, such as volatilization, drift, and movement of herbicide through soil or water are considered. Herbicide can move with eroding or windblown soil or with surface or subsurface water. Herbicides can also move through the air as spray drift, which occurs during herbicide application, and volatilization, which could occur after application. Spray

drift is dependent on spray equipment parameters such as nozzle orifice size, boom height and pressure, and wind speed (Branham and Hanson 1987). Volatility is dependent on the physical properties of the herbicide, primarily vapor pressure.

Volatilization is the conversion of a liquid or solid chemical to a gas. In the case of an herbicide that volatilizes, the vapor can then move with air currents away from the treatment site and affect non-target plants. The amount of volatilization that occurs is dependent upon climactic and microclimatic conditions. Soil moisture is the primary environmental condition that influences the rate at which herbicides volatilize; in general, herbicides volatilize more rapidly from moist soils than dry soils (Menalled and Dyer 2005). Volatilization also increases with higher air and soil temperatures and increasing wind speed. Ester formulations of herbicides have higher vapor pressures and volatilize more than amine formulations (Nice et al. 2004). No ester formulations are proposed for use by SCNF. Table 3-10 displays volatilization potential of herbicides being considered for aerial application under the proposed action.

Table 3-10: Herbicide Volatilization Potential of Herbicides Considered for Aerial Application

Herbicide	Volatilization Potential
2,4-D amine	Much less volatile than ester formulations[1]
Chlorsulfuron	Volatilization plays minor role in disappearance[2]
Clopyralid	Does not volatize readily in the field[1]
Dicamba	Volatilization not significant from soil surfaces, some may occur from plant surfaces[3]
Glyphosate	Does not volatize readily in the field[1]
Imazapic	Not volatile[1]
Metsulfuron-methyl	Does not volatize readily in the field[4]
Picloram	Does not volatize readily in the field[1]
Sulfometuron methyl	Not volatile[5]
Triclopyr TEA	Ester formulations highly volatile (FS uses amine)[1]

[1]Tu et al. 2001, [2]PMEP 1985, [3]EXTONET 1993, [4]Information Ventures 2003, [5]USDOE BPA 2000

The potential for volatilization can be minimized in a number of ways, some of which are operational and some environmental. Using water as a carrier and the use of specific adjuvants further reduces the likelihood of volatilization.

The climatic regime for the SCNF is one of low annual precipitation and soils are naturally dry, which reduces the potential for volatilization from soil. Aerial applications would be made primarily during morning hours when air and soil temperatures are lower and winds are calm or light. These conditions further reduce the likelihood of volatilization.

Spray drift is the movement of herbicide, generally via spray droplets, away from the target area. Spray drift can be reduced by increasing droplet size. This can be done by reducing spray pressure, increasing nozzle orifice size, using drift reduction nozzles, rearward nozzle orientation during aerial applications, and the addition of drift reductions adjuvants to the spray mix. Other factors that influence spray drift are the method of application, drift is generally greater from mist blower and aerial applications than ground application; the distance between the nozzle and target (less

distance will reduce drift); wind direction and wind speed; air stability; and temperature and humidity (low humidity and high temperatures causes rapid evaporation, which reduces the size of droplets). The influence of humidity and temperature is not always predictable, however (Dexter 1993). Spray drift cannot be completely eliminated; however, with proper management, drift levels can be minimized to levels that do not cause harm (Felsot 2001). General methods to reduce drift potential of herbicides considered for aerial application are discussed below. Appendix G contains the monitoring protocol that would use to detect drift and adapt application equipment and techniques in response to real-time monitoring.

Aminopyralid

For aerial applications, liquid formulations of aminopyralid are applied through specially designed spray nozzles and booms that are designed to reduce turbulence and maintain large droplet size to reduce drift (USDA Forest Service 2007). Applications may only be made under favorable weather conditions, which include wind speeds between 2 and 10 mph and not during temperature inversions (Dow AgroSciences 2013). It should be applied at rates of no less than two gallons per acre, although five gallons or greater per acre are recommended (Dow AgroSciences 2013). If electrostatic spray systems are used, then it can be applied at a rate of one gallon per acre (USDA Forest Service 2007).

Chlorsulfuron

Chlorsulfuron may be applied aerially at a minimum of three gallons per acre. Approximately 40 to 100 acres per hour may be treated. The most effective way to reduce spray drift is to apply large droplets that provide sufficient coverage and control. When applying by air in areas adjacent to sensitive non-target plants, solid stream nozzles oriented straight back should be used. To reduce drift, (a) avoid aerial application when the potential for inversion exists, (b) application should not be made in windy or gusty conditions and (c) helicopter boom length must not exceed 90% of rotor blade diameter. Ideally, application should be made no more than 10 feet above canopy unless a greater height is required for helicopter safety (DuPont 2011).

Clopyralid

Clopyralid has been shown to have little potential for drift during aerial applications (DiTomaso et al. 2004). To reduce any possible drift, the label recommends using straight stream nozzles, use spray booms no longer than ¾ of rotor length, utilize drift control systems and drift control additives. Aerial applications should be conducted when wind velocity is low and not applied during temperature inversions (Dow AgroSciences 2011a).

Imazapic

Aerial applications for imazapic are to be conducted only by helicopter for Forest Service purposes (2004d). Approximately 40 to 100 acres per hour may be treated. Liquid formulations are applied through specially designed spray nozzles and booms that are designed to reduce turbulence and maintain large droplet size to reduce drift (SERA 2004d). To reduce or prevent drift, applications should not be made in windy or gusty conditions (applications should occur when wind speeds are between 3 and 10 mph), high temperatures, low humidity, or temperature inversions (BASF 2011).

Metsulfuron-methyl

Metsulfuron-methyl may be applied aerially at a minimum of three gallons per acre. The most effective way to reduce spray drift is to apply large droplets (150 microns or larger) that provide sufficient coverage and control. When applying by air in areas adjacent to sensitive non-target plants, solid stream nozzles oriented straight back should be used. To reduce drift, (a) avoid aerial application when the potential for inversion exists, (b) application should not be made in windy or gusty conditions and (c) helicopter boom length must not exceed 90% of rotor blade diameter. Ideally, application should be made no more than 10 feet above canopy unless a greater height is required for helicopter safety (DuPont 2012).

Picloram

Aerial applications for picloram are to be conducted only by helicopter for Forest Service purposes (SERA 2011c). Approximately 40 to 100 acres per hour may be treated. Liquid formulations are applied through specially designed spray nozzles and booms that are designed to reduce turbulence and maintain large droplet size to reduce drift (SERA 2011c).

Sulfometuron-methyl

The most effective way to reduce spray drift during a sulfometuron-methyl application is to apply large droplets (150 microns or larger) that provide sufficient coverage and control. When applying by air in areas adjacent to sensitive non-target plants, solid stream nozzles oriented straight back should be used. To reduce drift, (a) avoid aerial application when the potential for inversion exists, (b) application should not be made in windy or gusty conditions and (c) helicopter boom length must not exceed 90% of rotor blade diameter and boom position must prevent droplets from entering rotor vortices. Ideally, application should be made no more than 10 feet above canopy unless a greater height is required for helicopter safety. This herbicide may only be applied when the potential for drift to adjacent sensitive areas is minimal (DuPont 2013).

Direct and Indirect Effects of Aerial Application

Under the proposed action, aerial application of herbicides could occur on up to 8,000 acres annually. This amounts to approximately 16 percent of inventoried invasive plant infestations and 0.3 percent of the project area. For the purpose of this analysis, it is assumed that an aerial application is a broadcast application.

The broadcast nature of aerial application would, in the short term, affect non-target vegetation across larger areas compared to ground-based broadcast or spot applications. For this reason, the SCNF would apply design criteria (Appendix J) to reduce the effects of aerial application to non-target vegetation. These include measures such as herbicide selection, applying more selective and less toxic herbicides such as aminopyralid and clopyralid, and using the lowest effective use rate. For example, since glyphosate is a non-selective herbicide, it would not be used for aerial application. Only upland sites would be treated with aerial application to reduce effects to non-target deciduous trees and shrubs. Conifer cover types with more than 30 percent overstory canopy cover would not be treated using aerial application. Aerial application of herbicides would be limited to lands greater than 300 feet from live water so the potential impacts to non-target riparian vegetation would remain the same as those for ground-based applications.

Seven herbicides are being considered for aerial application (Table 2-10). The direct and indirect effects of these herbicides on non-target vegetation are the same regardless of the application

method; whether the herbicide is applied using a ground-based broadcast application system, like a spray truck, or applied using a helicopter with strict adherence to design criteria and herbicide label direction. The potential for drift during aerial application is higher than ground-based applications, but there are standard operational practices that successfully manage drift concerns, drift control agents, appropriate type and size of nozzle, appropriate boom length and application pressure, applying at the lowest safe elevation, and applying in optimal weather conditions (Wolf 2000). The number of acres treated annually would increase in years in which herbicides were applied aerially. Necessarily, this would also increase the amount of broadcast acreage, creating a concurrent increase in the adverse effects of herbicide application to non-target vegetation in the areas treated aerially.

The potential effects at the site level would be the same as a ground-based broadcast application. The difference is one of scale in that larger acreages would be treated aerially than can be treated using ground-based equipment. However, from a project area perspective, even though aerial application has the potential to apply herbicides over larger areas, implementation of the proposed action would only aerially treat less than one-half of one percent of the project area (8,000 acres) annually. At a landscape scale, the potential short-term impacts to non-target vegetation in the project area would be minor; however, the long-term benefit of reduced invasive plant cover in these infestations could contribute to increased density of desirable vegetation with improved productivity and vigor.

Beneficially, areas that are presently un-infested, but “at risk” to invasive plant invasion would be more protected by aerially applying herbicides to infestations that are currently uncontrolled, thus establishing containment boundaries. Additionally, aerial application would provide for landscape level restoration efforts to manage invasive plants and maintain or improve ecosystem resilience.

Aquatic Herbicide Application

At this time there are no known infestations of aquatic invasive plant species occupying waters within the project area or anywhere else in the SCNF. There are two known species of littoral weeds (i. e. weeds that grow with their roots in or very near the water and with their foliage well above the surface of the water) that infest lands within the project area. These are Japanese knotweed and salt cedar; both of these species occur in riparian areas or grow adjacent to water, but do not grow beneath the surface of the water. Both of these species have the ability to grow beyond the immediate vicinity of water, but at this time they are only found growing immediately adjacent to water. To date, they have been managed for eradication as riparian weeds utilizing treatment techniques, herbicides and design criteria associated with terrestrial plants. However, aquatic invasive plants have been found in neighboring areas in Idaho and adjoining areas. Inclusion of treatment of aquatic invasive plant is for the purpose of being prepared to detect and eradicate aquatic invasive plants when they reach SNCF waters. Implementation of the proposed action alternative would allow quick response to aquatic invasive plants. Early detection and treatment would minimize the impacts of treatment and would reduce the impacts of invasion to native aquatic vegetation.

Multiple surveys of water bodies within the project area have been conducted by the Forest Service, state, and county managers over the recent years. Although invasive plants occupy lands within the riparian area, none have been found growing in the water. Of the 21 aquatic invasive plants, 13 are known to infest waters within the State of Idaho (Appendix A). With that in mind, these 13 species

have been identified as the most likely to be introduced into the project area. Although there are 13 species identified as the most likely to be introduced, the Forest would continue to survey for all of the aquatic invasive plants, including plants on the SCNF Watch List (Appendix A).

The State of Idaho has two invasive species management plans that provide direction toward the management of aquatic invasive plants within the project area, the first of these plans is the Idaho Invasive Species Strategic Plan 2012 – 2016 (ID Dept. Ag. 2012), the second of these plans is the Idaho Aquatic Nuisance Species Plan of 2007 (Idaho Invasive Species Council Technical Committee 2007). In particular, the Idaho Aquatic Nuisance Species Plan (2007) outlines a Rapid Response Strategy which the forest plans to implement if an aquatic invasive species is found occupy waters within the forest.

In many ways, aquatic invasive plants are similar to terrestrial invasive plants. There are annuals and perennials. Many flower and produce seed, others propagate only asexually. Some produce tubers or winter buds, some are more shade-tolerant than others, and nearly all respond to fertilization. Therefore, the management and control of these pests is similar, in many respects, to that of terrestrial invasive plants (Morgan and Patten 2012).

Herbicide treatment options are generally associated with three broad categories of aquatic invasive plants, emergent, submersed and floating. Emergent plants (sometimes called bank or marginal plants) are those rooted or anchored in the substratum with most of the leaf stem tissue above the water surface. They do not rise and fall with the water level. Examples include: purple loosestrife (*Lythrum salicaria*), Japanese knotweed (*Polygonum cuspidatum*) and salt cedar (*Tamarix spp*.). Submersed plants are adapted to grow with all or most of their vegetative tissue below the water surface. Examples of submersed plants include pondweeds (*Potamogeton spp*.), Eurasian watermilfoil (*Myriophyllum spicatum*) and Brazilian elodea (*Egeria densa*). Floating plants are those that are either free-floating or anchored to the substratum. They produce most of their leaf stem tissue, or thalli, at or above the water surface. Leaves or thalli of floating plants rise and fall with the water level. An example of floating plants include the water hyacinth (*Eichhornia sp*.), although other aquatic invasive plants on the Idaho noxious weed list can survive in a free floating form, an example of this is fanwort (*Cabomba sp*.).

The SCNF proposes to use four herbicides for the treatment of aquatic invasive plants. Two of these herbicides (glyphosate and triclopyr TEA) are already authorized for use in the treatment of terrestrial invasive plants. The two herbicides that the SCNF proposes to add to its tool box to manage aquatic invasive plants are imazamox and imazapyr. Table 3-11 displays these four herbicides as proposed for use by plant growth form.

Table 3-11: Herbicide Treatment Options by Growth Form

Growth Form	Aquatic Use Herbicides			
	Glyphosate	Imazamox	Imazapyr	Triclopyr TEA
Submersed Invasive Plants		X		X
Emergent Invasive Plants	X	X	X	X
Broadleaf; Floating and Emergent	X	X	X	X
Floating Invasive Plants	X			

Application techniques for the treatment of aquatic invasive plants fall into two basic types, foliar application and submersed aquatic. In a foliar application, the herbicide is mixed with water and

sprayed on the foliage of floating or emergent plants in a given area. The goal during foliar application of an aquatic herbicide is to obtain good coverage and ensure that the maximum amount of herbicide is taken up by the target weed. The foliar application of herbicides to emergent and floating-leaved plants is generally well understood by homeowners because this is common practice on ornamental lawn and garden plants.

The application of herbicides for submersed weed control, however, is often more complicated and thus more difficult to understand (Gettys et al. 2009). In an application for submersed aquatic invasive plants, herbicide is applied into the water and the target plant uptakes the active ingredient through the water. The control of submersed aquatic weeds is much more difficult than control of emergent aquatic plants for the following reasons (Gettys et al. 2009):

- Fewer herbicides are registered for submersed treatments
- The dilution effect of water depends on the depth of the water
- Wind, waves and currents dilute herbicides
- It takes more time to treat and cover submersed plants
- Submersed weeds are generally much more expensive to treat
- The growth stage and area covered by the plants are important
- Use of treated water for irrigation and drinking may be restricted

These general factors and additional site-specific factors would be used to determine which herbicides and application technique should be used to control submersed aquatic invasive plants. When making aquatic herbicide applications, all the design criteria for general herbicide application apply as well as design criteria specific to aquatic herbicide applications. Examples of aquatic herbicide application scenarios are located in Appendix M.

Rehabilitation and Restoration Practices

The direct and indirect effects of rehabilitation and restoration practices as implemented by Alternative 3 would be the same as those disclosed under Alternative 2, Proposed Action.

Cumulative Effects

Biological Control

Cumulative effects of biological control as implemented by Alternative 3 would be the same as those disclosed under Alternative 2, Current Action.

Herbicide Control

Cumulative effects would generally be the same as those described under Alternative 2, with the exception of the three new program components: additional herbicides and the inclusion of aerial and aquatic herbicide application. There would be no cumulative adverse effects to vegetation resources resulting from FS and other jurisdictions' weed control activities, all of which follow applicable state and federal requirements.

Beneficial effects of weed control accrue at both the site level and at the plant community and landscape level. These include improved plant community composition and ecosystem resilience. The potential increase in acres treated could result in short-term impacts to non-target vegetation, but could provide for long-term benefits in terms of plant community composition and

ecosystem resilience. These beneficial effects would not only be realized within the project area, but would also benefit lands beyond the project area by reducing the movement of invasive plant reproductive propagules or seeds from FS lands.

At present, there are no changes planned for management in the FC-RONR Wilderness. IWM would continue in the FC-RONR Wilderness, including biological control, herbicide control and mechanical control. However, there would be no aerially-applied herbicides in the FC-RONR Wilderness. If implemented, the SCNF Proposed Action would not overlap FC-RONR Wilderness boundaries with aerial applications.

Butte, Custer, and Lemhi Counties are all making use of the newer, low toxicity herbicides. IWM programs on adjacent non-National Forest System lands could be more effective since the SCNF, working cooperatively with these entities, would also be able to use more effective herbicides with fewer non-target vegetation effects. In the SCNF, more than two-thirds of invasive plant infestations in the project area are one acre in size or less (USDA Forest Service NRIS database). Moreover, the cover of invasive plants in most infestations under management is less than 10 percent. IWM in the project area would continue to identify such infestations as high priorities for treatment. Herbicide application at these sites would continue to be very low, although the products used would shift to new, less toxic herbicides with lesser effects on non-target vegetation. There would be no increase in cumulative effects from the shift to newer herbicides.

As far as is known, there are few aerial applications of herbicide in Butte, Custer, and Lemhi Counties. Aerial applications on private land are known to have occurred in the past; however, the SCNF has no data on these applications. Aerial application could be a useful tool along jurisdictional boundaries. With aerial application of herbicides, the SCNF would be able to establish containment boundaries and prevent infestations that are currently unmanaged from spreading at uncontrolled rates of spread. This could reduce the spread of invasive plants growing in National Forest System lands onto other jurisdictions. An increase in the amount of lands treated with aerially herbicide applications by other jurisdictions is not anticipated, although how that may change in the coming years is unknown.

In the SCNF, aerial herbicide application would occur on infestations for which there are few, if any, management options at present. Although aerial application could occur on a maximum of 8,000 acres, this is a high estimate that would depend on funding availability. In practice, much lower acreages would be accomplished with aerial application. Effects from aerially-applied herbicides would be limited to the SCNF since other invasive plant management entities are presently making few, if any, aerial applications.

There are no known infestations of aquatic invasive plants anywhere in Butte, Custer, or Lemhi Counties. As with the SCNF, each of these programs is practicing early detection for the arrival of aquatic invasive plants. County managers are prepared to initiate control measures immediately upon detection. Under the Proposed Action, the SCNF would also be prepared to initiate invasive plant control to eradicate infestations of aquatic invasive plants. There would be beneficial cumulative effects in that eradication of infestations would help prevent the local movement of aquatic invasive plants from one water body to others located in the three counties.

There would be little, if any, overlap between the SCNF and other management jurisdictions for several reasons. The Forest Service and other jurisdictions in Butte, Custer and Lemhi Counties do

not overlap, although they share administrative boundaries. With the exception of rivers and streams, most water bodies do not cross administrative boundaries, but are contained within a single jurisdiction. Aquatic invasive plants would be most likely to establish in lower elevation lakes and ponds with areas of warm, shallow water. Since surveys are conducted annually for the presence of aquatic invasive plants, infestations would likely be very small, few in number and spatially and temporally separated.

The amount of herbicides used for eradication of aquatic invasive plants would be small, given that there are no existing infestations and the focus is on early detection and a rapid response when they are found. The SCNF has identified those herbicides that would be used to treat aquatic invasive plants (Table 2-10). It is unknown which herbicides would be selected for use by the BLM, Butte, Custer and Lemhi Counties, other invasive plant management entities or private landowners. Governmental invasive plant management entities in the three counties all use similar IWM strategies. They would use only EPA-registered herbicides labeled for aquatic applications and would perform applications based on label direction, whichever herbicide was selected. Based on that fact that infestations of aquatic invasive plants would be very small and few in number and potentially scattered among the various invasive plant management jurisdictions, it seems unlikely that there would be adverse cumulative effects resulting from the treatment of aquatic, invasive plants.

Manual and Mechanical Control

Cumulative effects of mechanical control as implemented by Alternative 3 would be the same as those disclosed under Alternative 2, Proposed Action.

Rehabilitation and Restoration Practices

The cumulative effects of rehabilitation and restoration practices as implemented by Alternative 3 would be the same as those disclosed under Alternative 2, Proposed Action.

Conclusion

Consideration of adverse cumulative effects of herbicide application to desired and native plants on lands in and around SCNF are the very similar to those of direct and indirect effects (refer to sections on herbicide effects under the Current Action alternative above); the primary difference is that of scale. Additionally, there is no spatial overlap; the BLM and County herbicide outputs displayed in this discussion of cumulative effects do not occur on National Forest System lands.

In terms of beneficial cumulative effects, BLM and County IWM programs, private landowners and others would benefit from implementation of the Proposed Action since it (a) implements the use of new, less toxic and more selective herbicides, (b) permits the use of aerial application on infestations that presently uncontrolled or poorly controlled and (c) establishes control measures for aquatic invasive plants when and where they infest SCNF water bodies.

Proposed Action Vegetation Management Summary

Implementation of the Proposed Action would substantially improve the SCNF's IWM program. Less toxic herbicides could be used, effects to non-target vegetation could be reduced, IWM methods could be incorporated on infestations that are not currently being treated or are poorly controlled,

and infestations of aquatic invasive plants would be responded to as soon as they were detected. Implementation of the Proposed Action may provide a substantially greater reduction in the cover and density of invasive plants in infested areas as compared to the current invasive plant management. The spread of existing invasive plant infestations into un-infested native plant communities could be greatly reduced, especially with the inclusion of aerial herbicide application. There would be an increase in the amount of broadcast herbicide application in areas where aerial herbicide application was used. However, in the SCNF, invasive plant cover in many infested areas is generally low (≤ 10 percent) and many infestations are small (a few acres in size), therefore spot treatment would remain the most commonly used herbicide application method. Overall, impacts from control of invasive plants to desired and native plant communities would be minor with regard to species' abundance, diversity and distribution in the SCNF, especially with a shift to newer herbicides. Although non-target vegetation can be affected by invasive plant control activities, there is greater potential for adverse effects to structure and function of native plant communities if invasive plants are not controlled. Implementation of the Proposed Action would promote a gradual return to a species composition, cover, density, structure, and function more reflective of native plant communities, even where invasive plants cannot be fully removed from a site. The benefits of managing invasive plants are numerous. Fundamentally, these benefits include the conservation of native plants, community diversity, structure and function. This, in turn, benefits organisms dependent on the habitats provided by a plant community.

The Proposed Action alternative complies with federal legal requirements and FS national and regional direction on the management of non-native invasive plants species. Compared to the Current Action alternative and other action alternatives, implementation of the Proposed Action alternative offers the highest likelihood of achieving the desired condition for sites impacted by non-native invasive plants in the SCNF. In conclusion, with implementation of the Proposed Action alternative, the following are likely outcomes in the SCNF:

- an adaptive, integrated program that meets FS national and regional direction for invasive plant management on National Forest system lands and which incorporates all nationally recognized elements of invasive plant management
- provides a mechanism for adopting herbicides that are less toxic and potentially more effective than herbicides currently in use
- approval for the use of three additional herbicides
- the ability to control invasive plant infestations with aerial herbicide applications with treated and applied accomplishments of up to 8,000 acres annually depending on treatment priorities and availability of funding
- the establishment of parameters for existing invasive plant control activities, including potential accomplishments for biological control (2,000 acres), ground-based herbicide application (3,200 applied acres annually distributed across 8,000 treated acres annually) and 2,000 acres of mechanical control.
- control of aquatic invasive plant species, should they invade and establish in SCNF waters, and approval to use herbicides to control aquatic invasive species

3.2.6.5. Alternative 4-No Aerial Herbicide Application

Direct and Indirect Effects

Direct and indirect effects as implemented by Alternative 4 (No Aerial Herbicide Application alternative) would be the same as those disclosed under Alternative 3 (Proposed Action), except that there would be no helicopter aerial application of herbicide. This would result in (a) in a continued inability to adequately control large, currently untreated or poorly controlled invasive plant infestations that are not accessible by ground-based equipment and (b) correspondingly there would be fewer treated and applied acres since treatment with aerial herbicide application of up to 8,000 acres annually would not be approved. The outcome would be continued expansion of these invasive plant infestations, increased cover and density of invasive plants within the infestations, establishment of spot infestations beyond the main boundaries of the infestations and potential spread into currently uninfested areas.

Alternative 4 marginally complies with federal legal requirements and, overall, with Forest Service national and regional direction on the management of non-native invasive plants species. Compared to the Current Action, implementation of Alternative 4 provides the ability to adaptively manage invasive plants by incorporating the use of additional herbicides and the ability to manage aquatic invasive plant should infestations be found in SCNF waters. Compared to the Proposed Action, Alternative 4 has a lesser likelihood of achieving the desired condition for sites impacted by non-native invasive plants in the SCNF and the objectives of the SCNF invasive plant management. In conclusion, with implementation of Alternative 4, the following are likely outcomes in the SCNF:

- an adaptive, integrated program that meets Forest Service national and regional direction for invasive plant management on National Forest system lands and which incorporates all nationally recognized elements of weed management
- provides the SCNF with a mechanism for adopting herbicides that are less toxic and potentially more effective than herbicides currently in use
- approval for the use of three additional herbicides
- the establishment of parameters for existing invasive plant control activities, including potential accomplishments for biological control (2,000 acres), ground-based herbicide application (6,400 applied acres annually distributed across 16,000 treated acres annually) and 2,000 acres of mechanical control.
- control of aquatic invasive plant species, should they invade and establish in the SCNF , and approval to use herbicides to control aquatic invasive species

Alternative 4 does not provide the ability to control invasive plant infestations with aerial herbicide applications on infestations that are not accessible to ground-based equipment. The only weed control option available would be biocontrol at sites that are inaccessible or impractical for ground-based equipment.

Invasive plant treatments as described in accordance with Alternative 4 would have relatively short-lived detrimental effects and long-term beneficial effects, as displayed for Alternative 3. Detrimental effects to non-target plant species from biological control, ground-based herbicide application and mechanical control, as described under Alternative 3, would be minimized through the implementation of the design criteria displayed in Appendix J.

Cumulative Effects

Cumulative effects as implemented by Alternative 4 (No Aerial Herbicide Application alternative) would be the same as those disclosed under Alternative 3 (Proposed Action).

3.2.6.6. Alternative 5-No Aquatic Herbicide Application

Direct and Indirect and Effects

The direct and indirect effects as implemented by Alternative 5 (No Aquatic Herbicide Application) would be the same as those disclosed under Alternative 3, Proposed Action, with the exception that there would be no herbicide treatment of aquatic invasive plants when and where they establish in SCNF waters. Depending on the size of the infestation and/or species of aquatic invasive plant detected, this could result in the rapid spread and permanent establishment of aquatic invasive plants in suitable habitats. Manual and mechanical treatments may be effective control for some small infestations in the invaded bodies of some aquatic invasive plant species; however, manual and mechanical treatments alone are not an effective eradication technique for all aquatic invasive plant species or larger infestations. In turn, once aquatic invasive plants were established in one SCNF water body, this could greatly increase the likelihood of aquatic invasive plants being spread from this initial source into other SCNF waters is greatly increased.

Compared to the Current Action, the implementation of Alternative 5 provides the SCNF with the ability to adaptively manage invasive plants by incorporating the use of additional herbicides and the ability to undertake control of large, untreated infestations using aerial herbicide application. However, compared to the Proposed Action, Alternative 5 has a lesser likelihood of achieving desired conditions and meeting weed management objectives since infestations of aquatic invasive plant infestations could not be chemically controlled once found. In conclusion, with implementation of Alternative 5, the following are likely outcomes in the SCNF:

- Does not comply with federal legal requirements or with Forest Service national and regional direction for the management of non-native invasive plant species due to the inability to control aquatic invasive plant infestations utilizing an IWM approach.
- Could threaten the integrity of aquatic ecosystems within and beyond the project area by not providing for the control of aquatic invasive plants.
- Provides the SCNF with a mechanism for adopting new herbicides that are less toxic and potentially more effective than herbicides currently in use
- Approval for the use of three additional herbicides
- Establishment of parameters for existing invasive plant control activities, including potential accomplishments for biological control (2,000 acres), ground-based herbicide application (3,200 applied acres annually distributed across 8,000 treated acres annually) and 2,000 acres of mechanical control.
- Control of currently untreated or poorly controlled invasive plant infestations through the use of aerial herbicide application, up to 8,000 treated and applied acres per year

Invasive plant treatments as described in accordance with Alternative 5 would have relatively short-lived detrimental effects and long-term beneficial effects, as displayed under Alternative 3, with the exception of aquatic invasive plants. Detrimental effects to non-target plant species from biological control, ground-based herbicide application, and manual and mechanical control, as described

under Alternative 3, would be minimized through the implementation of the design criteria displayed in Appendix J.

Cumulative Effects

The direct, indirect and cumulative effects as implemented by Alternative 5 (No Aquatic Herbicide application) would be the same as those disclosed under Alternative 3, Proposed Action

3.3. Soil and Water Resources

3.3.1. Introduction

The Proposed Action and alternatives can potentially have direct and indirect effects on soil and water resources. Potential direct effects include erosion from physical disturbance resulting from mechanical treatments, and water quality impacts resulting from chemical treatments. Public comments have identified concerns about the potential impacts of chemical invasive plant treatments on surface and groundwater quality. Potential indirect effects are related to the effects that invasive plants can have on the landscape, including adverse effects on soil and water resources. Loss of native vegetative cover can result in soil loss, water quality impacts, impacts to riparian vegetation, and impacts to stream channel morphology. Treatment of invasive plants can help maintain native vegetative ground cover and prevent many of these impacts.

3.3.2. Measurement Indicators

The following measurement indicators are used to frame the analysis and address key issues related to soil and water resources. These indicators allow for quantitative and qualitative comparisons between the alternatives presented in this EIS.

- Instream Sediment Loads: Estimated change in hillslope and stream bank sediment delivery to streams (based on qualitative evaluation).
- Herbicide Concentrations in Water: Estimated concentrations of herbicides in streams and other surface waters, groundwater, and drinking water source areas (based on modeling).
- Riparian Function: Estimated change in invasive plant infested acres within Riparian Habitat Conservation Areas, as a measure of riparian and stream channel function.
- Soil Condition: Estimated change in soil condition (based on qualitative evaluation).

3.3.3. Compliance with Forest Plan and Other Relevant Direction

Forest Plan

The following Forest Goals and Forest Standards and Guidelines for soil and water resources from the Salmon National Forest Land and Resource Management Plan (USDA Salmon NF 1988) and the Challis National Forest Land and Resource Management Plan (USDA Challis NF 1987) are applicable to this project:

Salmon National Forest Goals

- Maintain watershed condition and water quality such that downstream beneficial uses are protected and compliance with State standards is achieved.
- Conduct management and resource development within riparian zones in a manner compatible with protection of water quality and fish habitat.

Salmon National Forest Standards and Guidelines for Water Resources

- Improve and maintain water quality to meet State water quality standards.
- Conduct nonpoint source activities in accordance with applicable Best Management Practices (BMPs).
- Timber harvest, road construction, mining, range revegetation and similar activities which have a significant soil disturbing impact will not be permitted on lands identified in soil resource inventories as exhibiting high mass stability hazard.
- Long-term water quality will be maintained or improved in all municipal watersheds.
- Limit use of herbicides, insecticides, rodenticides, or other chemical agents as part of management activities to times and places where possible transport to or by surface water has a low probability of occurrence.
- Prevent stream channel instability, loss of channel cross-sectional areas, and loss of water quality resulting from activities that alter vegetative cover.
- Maintain sediment yield within threshold limits.
- Avoid channelization of natural streams.
- Treat disturbed areas resulting from management activities in the shortest possible time to meet water quality objectives.
- Riparian zones will be managed in a manner compatible with protection of water quality and fish habitat.

Salmon National Forest Standards and Guidelines for Soil Resources

- Maintain soil productivity, minimize man-caused soil erosion, and maintain the integrity of associated ecosystems.
- Identify at the project level, filter strip requirements immediately adjacent to streams, in order to reduce sediment delivery from roads or other major surface disturbance.

Challis National Forest Goals for Soil and Water Resources

- Provide soil and water guidance to other resource activities to protect or improve water quality and soil productivity.
- Improve watershed condition on the Forest.

Challis National Forest Standards and Guidelines for Soil and Water Resources

- Ensure that all management-induced activities meet State water quality standards, and Forest water quality goals, including sediment constraints.
- Impacts of activities may not increase fine sediment by depth (within critical reaches) of perennial streams by more than 2% over existing levels. Where existing levels are at 30% or above new activities that would create additional stream sedimentation would not be allowed.

PACFISH/INFISH Guidance

The Pacific Anadromous Fish Management Strategy (PACFISH) provides management direction for all activities and projects that pose an unacceptable risk to anadromous fish and their critical habitat in anadromous fish-producing watersheds in eastern Oregon and Washington, Idaho, and portions

of California. PACFISH guidance defines Goals, Riparian Management Objectives (RMOs), Riparian Habitat Conservation Areas (RHCAs), Standards and Guidelines, and monitoring requirements for protection of riparian areas (USDA Forest Service and USDI BLM 1995). In 1995, this direction amended the Salmon and Challis National Forest Land and Resource Management Plans. PACFISH guidance applies to those portions of the project area within the Salmon River Basin.

The Inland Native Fish Strategy (INFISH) was also implemented in 1995 to protect habitat and populations of resident native fish outside of anadromous fish habitat in eastern Oregon, Idaho, western Montana, and portions of Nevada. Similar to PACFISH, INFISH defines Goals, RMOs, RHCAs, Standards and Guidelines, and monitoring requirements for protection of riparian areas (USDA Forest Service 1995). INFISH amended the Challis National Forest Land and Resource Management Plan. INFISH applies to those portions of the project area within the Big Lost River and Little Lost River basins.

Clean Water Act

The Federal Water Pollution Control Act of 1972 (Public Law 92-500) as amended in 1977 (Public Law 95-217) and 1987 (Public Law 100-4) is also known as the federal Clean Water Act. This Act provides the structure for regulating pollutant discharges to waters of the United States. As stated in Section 101 of the Act, the objective of the Act is "…to restore and maintain the chemical, physical, and biological integrity of the Nation's waters". Control of point and nonpoint sources of pollution are among the means to achieve the stated objective. The U.S. Environmental Protection Agency (EPA) administers the Act, but many permitting, administrative, and enforcement functions are delegated to state governments. In Idaho, the designated agency is the Idaho Department of Environmental Quality (IDEQ).

Certain sections of the Act have special importance in management of nonpoint source pollution. Sections 208 and 319 of the Act recognize the need for control strategies for nonpoint source pollution. Section 305(b) of the Act requires states to assess the condition of their waters and produce a biennial report summarizing the findings. Water bodies that have water quality determined to be either impaired (not fully meeting water quality standards) or threatened (likely to violate standards in the near future) are compiled by the State of Idaho Department of Environmental Quality (DEQ) in a separate list under Section 303(d) of the Act.

This list must be submitted to EPA every two years. Water bodies on the 303(d) list, known as Water Quality Limited (WQL) waters are to be targeted and scheduled for development of water quality improvement strategies on a priority basis. These strategies are in the form of Total Maximum Daily Loads (TMDLs) which define the quantity of pollutants that may be delivered to a water body without violating water quality standards. In practice they are plans to improve water quality in a listed water body until water quality standards are met (i.e., until designated uses are fully supported).

Waters of the United States

Waters of the United States (WOTUS) refers to waters over which the US Army Corps of Engineers will assert jurisdiction under the Clean Water Act. Defining WOTUS is a requirement of the permitting process for herbicide application on the Forest.

- Traditional navigable waters.
- Wetlands adjacent to traditional navigable waters, including those with no continuous surface connection to traditional navigable waters.
- Non-navigable tributaries of traditional navigable waters that are relatively permanent where the tributaries typically flow year-round or have continuous flow at least seasonally (e.g. typically three months).
- Adjacent wetlands that have a continuous surface connection to such tributaries (e.g. they are not separated by uplands, a berm, dike, or similar feature).
- Non-navigable, not relatively permanent tributaries and their adjacent wetlands where such tributaries and wetlands have a significant nexus to traditional navigable water. A significant nexus analysis will assess the flow characteristics and functions of the tributary itself and the functions performed by any wetlands adjacent to the tributary to determine if they significantly affect the chemical, physical, and biological integrity of downstream traditional navigable waters.

Based on this guidance, the Salmon-Challis National Forest defines WOTUS as perennial streams as identified in the National Hydrography Dataset (NHD), additional perennial streams field-identified by Forest personnel, perennial lakes and ponds identified in the NHD Waterbodies dataset, and all mapped wetlands (including swamp/marsh and spring features in NHD and any available wetland data from the National Wetland Inventory) within 300 feet of a perennial stream (MacFarlane 2012).

Forest Service Manual, Water Resource Management

Sections 2532.02 and 2532.03 of the Forest Service Manual describe the objectives and policies relevant to protection (and, where needed, improvement) of water quality on National Forest System Lands so that designated beneficial uses are protected (USDA Forest Service 1990). Guidelines for data collection activities (inventory and monitoring) are also described.

Forest Service Handbook, Soil and Water Conservation Practices Handbook

The Soil and Water Conservation Practices Handbook (FSH 2509.22, R1/R4 Amendment) (USDA Forest Service 1988c) presents a process to develop site specific conservation practices for use on National Forest System lands to minimize effects of management activities on soil and water resources, and to protect water-related beneficial uses. It describes the application, monitoring, evaluation, and adjustment of these conservation practices.

Specific practices applicable to this project include the following (Appendix O):

- Practice 13.07: Pesticide Use Planning
- Practice 13.08: Apply Pesticides According to Label and EPA Registration Directions
- Practice 13.09: Pesticide Application Monitoring and Evaluation
- Practice 13.10: Pesticide Spill Contingency Planning
- Practice 13.11: Cleaning and Disposal of Pesticide Containers and Equipment
- Practice 13.12: Protection of Water, Wetlands, and Riparian Areas during Pesticide Spraying
- Practice 13.13: Controlling Pesticide Drift during Spray Application

Forest Service Best Management Practices (BMPs)

The Forest Service National BMP program provides a standard set of core BMPs and a consistent means to track and document the use and effectiveness of BMPs on NFS lands across the country (USDA Forest Service 2012b). The objectives of this program include establishing "uniform direction for BMP implementation to control nonpoint source pollution on all NFS lands to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources that will meet the intent of the Federal and State water quality laws and regulations, Executive orders, and USDA and Forest Service directives." These National Core BMPs "require the development of site-specific BMP prescriptions based on local site conditions and requirements to achieve compliance with established State, tribal, or national water quality goals. It is expected that State requirements and BMP programs, Forest Service regional guidance, and the land management plan will provide the criteria for site-specific BMP prescriptions.

Forest Service directives implementing the National BMP program were published in the Federal Register for public review and comment (90 days) on May 6, 2014. These directives have not been finalized as of the time of this report.

The following BMPs from the National Core BMP Technical Guide (USDA Forest Service 2012b) are applicable to this project. Design criteria are tiered to these National Core BMPs (Appendix O).

- Plan-2: Project Planning and Analysis
- Plan-3: Aquatic Management Zone Planning
- Chem-1: Chemical Use Planning
- Chem-2: Follow Label Directions
- Chem-3: Chemical Use Near Waterbodies
- Chem-4: Chemical Use In Waterbodies
- Chem-5: Chemical Handling and Disposal
- Chem-6: Chemical Application Monitoring and Evaluation
- Veg-2: Erosion Prevention and Control
- Veg-3: Aquatic Management Zones
- Veg-8: Mechanical Site Treatment

Executive Order 11988, Floodplain Management

Executive Order 11988 requires that agencies avoid, to the extent possible, adverse impacts associated with occupancy and modification of floodplains. It applies to all floodplain locations, as a minimum to areas in the 100-year, or base, floodplain.

Executive Order 11990, Protection of Wetlands

Executive Order 11990 requires that agencies avoid, to the extent possible, adverse impacts associated with the destruction or modification of wetlands and avoid direct or indirect support of new construction in wetlands wherever there is a practicable alternative.

Idaho Water Quality Standards

Idaho State law defines the State's obligations to develop and enforce water quality standards to deal with problems related to personal health and water pollution. The State of Idaho has developed

water quality standards to protect public health and welfare, enhance water quality and comply with requirements of the Clean Water Act. Idaho State Water Quality Standards are administered under IDAPA 58, Title 01, Chapter 2 (Idaho DEQ 2012).

The Idaho State Antidegradation Policy applies to all waters subject to the jurisdiction of the Clean Water Act. This policy states that the level of water quality necessary to protect the existing uses shall be maintained and protected, and includes provisions to maintain and protect the water quality of High Quality Waters and Outstanding Resource Waters.

Surface water use designations are defined for Idaho waterbodies under IDAPA 58. Waters within the project area are generally classified under the following designated uses:

- Aquatic Life – Cold Water, Salmonid Spawning, or undesignated
- Recreation – Primary contact recreation, Secondary contact recreation, or undesignated
- Other – Domestic water supply

Waters with undesignated uses are presumed to support cold water aquatic life and primary or secondary contact recreation beneficial uses. Designated uses for a few streams within the project area are “none” as a result of mining activity.

Idaho Water Quality Standards establish water quality criteria for aquatic life use designations. Under the following standards for water temperature and turbidity, surface waters are not to vary from the following characteristics as a result of human activities:

- Water temperatures of 22 degrees C or less with a maximum daily average of no greater than 19 degrees C (more stringent criteria for areas used for bull trout streams and salmonid spawning in the time of spawning and incubation).
- Turbidity (below applicable mixing zone) shall not exceed background levels by more than 50 nephelometric turbidity units (NTU) instantaneously or 25 NTU for more than 10 consecutive days.

Idaho Water Quality Standards establish human health standards for chemical pollutants, including some herbicides. Of these water quality standards, the only standard applicable to this project is for 2,4-D.

- 2,4-Dichlorophenol concentrations should not be greater than 77 µg/L for human health for consumption of water and organisms, or 290 µg/L (for human health for consumption of organisms only).

Idaho Water Quality Standards also establish water quality criteria for waters designated as Small Public Water Supplies. This applies to Garden Creek, serving the City of Challis; and Chips Creek, Jesse Creek, and Pollard Creek, serving the City of Salmon. Of these water quality criteria, the turbidity standard is the only standard applicable to this project.

- Turbidity measured at the public water intake should not be increased by more than 5 NTU above natural background when background turbidity is 50 NTU or less

National Drinking Water Regulations

National Primary Drinking Water Regulations regulate concentrations of a variety of contaminants in drinking water (US EPA 2009). These legally enforceable standards apply to public water systems to protect public health. Three contaminants in these standards are applicable to this project (Table 3-12).

Table 3-12: National drinking water standards applicable to this project.

Contaminant	MCL * (mg/L)	Potential health effects from long term exposure above the MCL
2,4-D	0.07	Kidney, liver, or adrenal gland problems
Glyphosate	0.7	Kidney problems, reproductive difficulties
Picloram	0.5	Liver problems

MCL = Maximum Contaminant Level

Water Rights

Idaho Department of Water Resources (IDWR) manages water in the State of Idaho via water allocation and distribution processes. Water rights authorize the use of public water by private individuals and organizations. The right to use water for a beneficial use must be obtained from IDWR before a project is implemented.

3.3.4. Methodology for Analysis

3.3.4.1. Background Information

This analysis utilizes several sources of existing background information:

Best available science: Abundant scientific literature is available describing research on herbicide persistence in soil and water, the effects of various treatments on water quality and soils, and the effects of invasive plant infestations on runoff and erosion.

Herbicide Risk Assessments: Risk Assessments for each of the herbicides proposed for use in this project were produced for the US Forest Service by Syracuse Environmental Research Associates, Inc. (SERA). These risk assessments provide detailed information on herbicide behavior, persistence, and potential effects on soil and water, incorporating data from modeling of herbicides using the Groundwater Loading Effects of Agricultural Management Systems (GLEAMS) model. The intent of the generic modeling in Forest Service risk assessments is to develop extreme values for exposure assessments that are likely to encompass levels of exposure that might be realized in Forest Service programs (SERA 2007b).

Invasive plant control monitoring data: Monitoring data collected during implementation and monitoring of existing invasive plant control programs is a valuable source of information used to predict the effects of similar proposed treatments. Limited studies have been conducted on the Salmon-Challis National Forest (Rose 2002). More extensive studies have been conducted on aerial herbicide applications on the nearby Lolo and Bitterroot National Forests in Montana (USDA Wallowa-Whitman NF 2010).

Collective knowledge: Some of the information and assumptions used in this analysis are based on the collective knowledge provided by the Interdisciplinary Team, based on experience from decades of invasive plant treatment implementation.

Similar analyses: Information presented in other Environmental Impact Statements that have been completed for other invasive plant control programs is a valuable source of background information where conditions are similar.

3.3.4.2. Field Observations

Representative sites within much of this area have been visited by Salmon-Challis National Forest hydrology and soils staff over numerous years to evaluate potential effects on soil and water of activities including grazing, timber harvest, mining, and restoration, as well as impacts such as fire and flooding. Field observations and data are incorporated into the analysis where possible.

3.3.4.3. Modeling

The effects of invasive plant treatments and herbicide application on soil and water resources are estimated in this analysis through the following quantitative methods:

GLEAMS: The Groundwater Loading Effects of Agricultural Management Systems (GLEAMS) model was developed by the USDA and is maintained by the USDA Agricultural Research Service (ARS). GLEAMS is a field-scale root zone model that describes the fate of chemicals in various soil types and climatic conditions (Leonard et al. 1987). This model is used extensively in many of the Forest Service herbicide risk assessments referenced in this analysis that were completed prior to 2007 (SERA 2004a; 2004b; 2004c; 2004d; 2004e; 2004f; 2006) to model estimates of herbicide concentrations in streams, ponds, and soil following herbicide application.

Gleams-Driver: The Gleams-Driver model was developed by SERA for the US Forest Service as a pre-processor and post-processor for GLEAMS (SERA 2007b). Gleams-Driver prepares input files, runs the GLEAMS model, and reads and processes GLEAMS output. The Gleams-Driver model was used in Forest Service risk assessments referenced in this analysis that were completed in 2007 and later (SERA 2007a; 2010; 2011a; 2011b; 2011c; 2011d). The format of the Gleams-Driver inputs and outputs varies from the GLEAMS modeling.

Disturbed WEPP: The Water Erosion Prediction Project (WEPP) model was developed by USDA ARS. The Forest Service developed the Disturbed WEPP model as an interface to the WEPP soil erosion model, to describe disturbed forest and rangeland erosion conditions (Elliot and Hall, 2010). This model provides a probability of a given level of erosion occurring the year following a disturbance. The Disturbed WEPP Model 2.0 is used in this analysis to model hillslope erosion related to invasive plant expansion and the proposed invasive plant treatment activities.

3.3.4.4. Analysis Area

The project area includes 3,119,035 acres, covering the entire Salmon-Challis National Forest, exclusive of the Frank Church-River of No Return Wilderness. This project area was divided into the following five Invasive Plant Management Areas: Lemhi (329,446 acres), North (418,364 acres), Pahsimeroi-Lost (1,061,805 acres), Upper Salmon (650,802 acres), and Salmon (658,618 acres) (Map 1-1).

Over 49,000 acres of invasive plant infestations have been inventoried within the project area. Because some overlap exists between species in these inventoried infestations, the actual area of infestation is less than 49,000 acres. The total acres of inventoried infestations is used for the purpose of this analysis, with the understanding that in some cases it overestimates the actual area infested. However, the actual area infested may in fact be underestimated by these figures because of the likely existence of un-inventoried infestations. These values represent only estimates for the purpose of characterizing the existing condition.

3.3.5. Affected Environment

3.3.5.1. Watersheds

The project area lies within eleven sub-basins (4th-level watersheds) of the Salmon River and Upper Snake River Basins (Table 3-13). The project area lies within 71 5th-level watersheds ranging in size from about 33,000 to 322,000 acres, and 278 6th-level watersheds ranging in size from 10,000 to 231,000 acres. Elevations within the project area range from about 3,200 feet at Corn Creek along the Salmon River to 12,662 feet at Mount Borah.

Major stream courses draining the project area in the Salmon River Basin include the Salmon River, Middle Fork Salmon River, Lemhi River, and Pahsimeroi River. Major stream courses draining the project area in the Upper Snake River Basin include the Big Lost River and the Little Lost River, both draining southeast into subsurface aquifers of the Upper Snake River.

Approximately 77% of the existing invasive noxious plant infestations are located in the Middle Salmon-Panther subbasin. The 5th-level watersheds with the largest percentage of infested acres include North Fork Salmon River, Lower Panther Creek, Pine Creek-Salmon River, Indian Creek-Salmon River, and Owl Creek-Salmon River (Table 3-14). These watersheds are all located in the northern portion of the Middle Salmon-Panther subbasin, and inventoried invasive plant infestations on National Forest System lands cover more than 4% of the total watershed area in each of these watersheds.

Table 3-13: 4th-level Watersheds in the Project Area.

Basin Name (3rd-level watershed)	Sub-Basin Number and Name (4th-level watershed)	Acres within project area	% of watershed within project area	Acres of inventoried infestations on SCNF	% of all inventoried SCNF invasive plant infestations	Invasive Plant Mgmt. Zone(s)
170402 Upper Snake River	17040216 Birch	4,789	1%	11	0.0%	Lemhi
	17040217 Little Lost	268,892	44%	1002	2.0%	Pahsimeroi -Lost
	17040218 Big Lost	542,964	35%	1952	4.0%	Pahsimeroi -Lost
	17040221 Little Wood	2,655	0.3%	5	0.0%	Pahsimeroi -Lost
170602 Salmon River	17060201 Upper Salmon River	535,738	35%	1868	3.8%	Upper Salmon
	17060202 Pahsimeroi	247,283	46%	1369	2.8%	Pahsimeroi -Lost
	17060203 Middle Salmon-Panther	925,327	79%	37,696	76.7%	Salmon; North
	17060204 Lemhi	324,822	40%	2824	5.7%	Lemhi
	17060205 Upper Middle Fork Salmon	114,307	12%	103	0.2%	Upper Salmon
	17060206 Lower Middle Fork Salmon	112,720	13%	1790	3.6%	Salmon
	17060207 Middle Salmon-Chamberlain	39,538	4%	531	1.1%	North
	TOTAL	**3,119,035**		**49,153**		

Table 3-14: 5th-level watersheds in the project area with the largest invasive plant infestations.

5th-level Hydrologic Unit Code (HUC)	5th-Level Watershed Name	Watershed size (acres)	Acres of inventoried invasive plant infestations on NFS lands	% of watershed infested on NFS lands
1706020306	North Fork Salmon River	135,313	9,923	7.3%
1706020312	Lower Panther Creek	83,790	5,370	6.4%
1706020308	Pine Creek-Salmon River	65,215	3,704	5.7%
1706020307	Indian Creek-Salmon River	108,582	6,079	5.6%
1706020313	Owl Creek-Salmon River	65,162	2,658	4.1%

5th-level Hydrologic Unit Code (HUC)	5th-Level Watershed Name	Watershed size (acres)	Acres of inventoried invasive plant infestations on NFS lands	% of watershed infested on NFS lands
1706020304	Williams Creek-Salmon River	88,254	2,188	2.5%
1706020305	Carmen Creek-Salmon River	114,299	2,212	1.9%
1706020311	Middle Panther Creek	117,623	2,027	1.7%
1706020603	Lower Camas Creek	99,964	1,200	1.2%
1706020309	Upper Panther Creek	82,886	972	1.2%

3.3.5.2. Climate

The climate of the project area is characterized as dry forest, in the transition between the maritime climate of Northern/Western Idaho and the continental climate of Southeastern and Eastern Idaho. Summers are generally hot and dry, and winters are generally cold and snowy. Average annual temperatures range from about 35 to 47 degrees Fahrenheit, and most of the project area receives between about 8 and 18 inches of annual precipitation (Western Regional Climate Center 2014). Climate has a major influence on physical and biological conditions on the ground, including water availability, soil conditions, plant growth, wildfire potential, and ecosystem resiliency.

Drought conditions have been relatively common in the project area over the past decade, with official drought declarations occurring 5 out of 10 years in Lemhi and Custer Counties (IDWR 2014b).

3.3.5.3. Surface Water

The project area contains approximately 4,095 miles of mapped perennial streams and 5,935 miles of mapped intermittent or ephemeral streams, as defined by National Hydrography Dataset (NHD) mapping with edits made by the Salmon-Challis National Forest based on field observations. Because National Forest System lands are generally in the headwater areas, most of these stream miles are steep headwater streams draining high relief mountainous areas.

The project area also includes approximately 3,187 acres of small, scattered lakes, all less than 200 acres in size, as defined by NHD. Although wetlands are only mapped for a small portion of the project, wetlands within the project area are generally limited to riparian environments in valley floors and small, isolated springs and seeps (USDI FWS 2014c).

3.3.5.4. Riparian Areas

Riparian areas vary from narrow bands along headwater streams to expansive valley-wide floodplains in larger, low gradient channels. Riparian areas are subject to the requirements of PACFISH/INFISH, which limit ground-disturbing activities within Riparian Habitat Conservation Areas (RHCA). RHCAs are defined by 300-foot buffers on all fish-bearing streams, 150-foot buffers on perennial non-fish bearing streams, and 100-foot buffers on intermittent streams. The project area includes a total of 399,483 acres within RHCAs (Table 3-15).

Table 3-15: Invasive plant infestations within Riparian Habitat Conservation Areas in the project area

Riparian Habitat Conservation Areas	RHCA acres within project area	Acres of inventoried invasive plant infestations	Percent of RHCA area infested
100-foot buffer on intermittent streams	136,217	3,076	2.3%
150-foot buffer on perennial non-fish bearing streams	27,824	464	1.7%
300-foot buffer on fish-bearing streams	235,442	12,229	5.2%
TOTAL	399,483	15,769	3.9%

Approximately 32% of the inventoried invasive plant infested acres in the project area, or 15,769 acres lie within the 100-foot, 150-foot, and 300-foot RHCAs (Table 3-15). Infestations cover approximately 4% of all RHCAs within the project area. Invasive plant infestations within riparian areas are most common in the North and Salmon Invasive Plant Management Zones. The most prevalent invasive plants within these riparian areas are spotted knapweed, comprising 71% of all inventoried invasive plant within RHCAs. Other prominent invasive species noxious weeds include Canada thistle (7.4%), hoary alyssum (6.5%), musk thistle (4.1%), houndstongue (2.4%), leafy spurge (2.3%), yellow toadflax (2.0%), oxeye daisy (1.1%), and sulphur cinquefoil (1.0%).

3.3.5.5. Streamflows

Streamflows within the project area are primarily controlled by snowmelt runoff, with peak runoff occurring in May and June. Low flows typically occur from late summer through the winter months. Many intermittent streams draining small headwater basins in the Beaverhead, Lemhi, and Lost River Ranges only carry flow during snowmelt runoff, and many streams disappear into course sediments of alluvial fans at the bases of these mountain ranges. High intensity summer thunderstorms can produce intense rainfall capable of causing short duration flash floods in many of the steep drainages in the project area, particularly where wildland fire has impacted soils and groundcover.

Extreme flows often occur where high intensity summer thunderstorms occur over severely burned areas.

3.3.5.6. Water Quality

Water quality within the project area generally supports designated beneficial uses as described in the State of Idaho 2012 Integrated Report (Idaho DEQ 2014a), including cold water, salmonid spawning, primary contact recreation, secondary contact recreation, and domestic water supply. Factors influencing water quality include natural factors such as geology, fire, and atmospheric deposition, as well as land management activities that may lead to non-point sources of sediment or contaminants. Streams within the highly mineralized zone of the upper Salmon River tend to have high concentrations of metals. Fine sediments can be naturally prevalent within granitic landforms as a result of the high rate of granite decomposition.

Anthropogenic sources of water quality impairment, including sediment, temperature, bioassessment, fecal coliform, e-coli, and metals have resulted in the 303(d) listing of a number of streams within the project area (Idaho DEQ 2014a) (Table 3-16).

Total Maximum Daily Loads (TMDLs) have also been developed for 60 water bodies within the project area and are included within Idaho Department of Environmental Quality sub-basin assessments completed between 1999 and 2008.

Table 3-16: 303(d)-listed Impaired Water Bodies within Project Area

Assessment Unit Water Body	Miles	Pollutants*	TMDL
Little Lost River - Badger Creek to Big Spring Creek	27.0	FB,SS,TW	
Little Lost River - Wet Creek to Badger Creek	21.4	SS,TW	
Sawmill Creek - confluence of Timber Creek and Main Fork to	31.5	TW,CB	
Sawmill Creek - confluence of Timber Creek and Main Fork to	6.6	TW	X
Squaw Creek - source to mouth	12.5	TW	
Timber Creek - source to mouth	1.5	TW	
Dry Creek - source to Dry Creek Canal	39.0	TW	
Squaw Creek - source to mouth	3.5	CB	
Deer Creek - source to mouth	7.3	TW	
Pass Creek - source to mouth	40.7	CB	
Thousand Springs Creek - source to mouth	5.9	TW	X
Willow Creek - source to mouth	1.9	CB	
Big Lost River - Burnt Creek to Thousand Springs Creek	26.4	CB	
Big Lost River - Summit Creek to and including Burnt Creek	18.1	CB	
Bridge Creek - source to mouth	14.3	U-N	X
Wildhorse Creek - Fall Creek to mouth	5.0	FC	X
Salmon River - Pennal Gulch to Pahsimeroi River	10.5	CB,EC	
Squaw Creek - confluence of Aspen and Cinnabar Creeks to Cas	0.5	TW	
Aspen Creek - source to mouth	51.7	TW	
Aspen Creek - source to mouth	6.0	TW	
Aspen Creek - source to mouth	2.5	TW	
Bruno Creek - source to mouth	4.5	CB	
Basin Creek - East Basin Creek to mouth	2.0	SS	
East Fork Salmon River - Germania Creek to Herd Creek	16.5	CB	
Warm Spring Creek - source to Hole-in-Rock Creek	20.6	SS	
Broken Wagon Creek - source to mouth	1.9	SS	
Pahsimeroi River - Meadow Creek to Patterson Creek	13.5	CB,SS,TW	
North Fork Lawson Creek - source to mouth	9.9	CB	
South Fork Lawson Creek - source to mouth	3.1	CB	
Meadow Creek - source to mouth	10.0	CB,FC	
Grouse Creek - source to mouth	24.8	CB	
Goldburg Creek - source to Donkey Creek	14.6	FC	
Big Creek - confluence of North and South Fork Big Creeks to	0.4	SS,U-N	
Big Deer Creek - South Fork Big Deer Creek to mouth	3.0	MM	
South Fork Big Deer Creek - Bucktail Creek to mouth	0.5	MM	
Panther Creek - Napias Creek to Big Deer Creek	6.1	MM	
Panther Creek - Blackbird Creek to Napias Creek	7.0	CB	
Panther Creek - Blackbird Creek to Napias Creek	5.5	MM	
Trail Creek - source to mouth	9.5	CB	
Salmon River - Carmen Creek to North Fork Salmon River	6.3	U-N	
Wallace Creek - source to mouth	7.4	SS,TW	
Salmon River - Williams Creek to Pollard Creek	19.9	CB	
Cow Creek - source to mouth	27.0	CB	
Mill Creek - diversion (T16N, R24E, Sec. 22) to mouth	0.6	SS,U-N	

Assessment Unit Water Body	Miles	Pollutants*	TMDL
Walter Creek - source to mouth	0.6	CB	
Eighteen mile Creek - source to Divide Creek	1.2	CB	X
Canyon Creek - source to diversion (T16N, R26E, Sec.22)	58.3	CB,EC	
Little Eightmile Creek - source to diversion (T16N, R25E, Se	19.2	TW	
Sandy Creek - source to diversion (T20N, R24E, Sec. 17)	4.3	TW	X
Bohannon Creek - source to diversion (T21N, R23E, Sec. 22)	1.9	TW	X
Bear Valley Creek - 5th order	0.1	TW	
Total	**634.0**		

** FB=Fishes Bioassessments, SS=Sedimentation/Siltation, TW=Temperature, water, CB=Combined Biota/Habitat Bioassessments, U-N=Cause Unknown – Nutrients Suspected Impairment, FC=Fecal Coliform, EC=Escherichia Coli, MM=Metals from Mining Activity, U=Cause Unknown.*

A total of 1,483 acres of inventoried invasive plant infestations occur within 300 feet of the 303(d) listed water bodies within the project area. Impaired waterbodies with the largest concentrations of inventoried invasive plants within 300 feet include (from north to south) Trail Creek, Panther Creek, tributaries of the Salmon River in the Williams Creek to Pollard Creek assessment units, Canyon Creek, Sawmill Creek, and Pass Creek.

Sediment is an important water quality parameter that factors into many land management decisions on the Salmon-Challis National Forest because of the high potential for erosion and the sensitivity of spawning habitat for listed fish species. Since 1993, the Forest has monitored the percentage of fine sediments at depth (less than 0.25-inch diameter) at 182 established monitoring sites on streams within the project area. The sediment standard for the Salmon National Forest is 20 percent fines for streams supporting anadromous species and 28.7 percent fines for streams supporting only resident salmonid species (USDA Salmon NF 1988). The sediment standard for the Challis National Forest is 30 percent for all streams (USDA Challis NF 1987). A value in excess of 30 percent would initiate a modification of management strategy on the Challis National Forest.

Sediment data from these sampling sites indicate that these sediment standards are generally but not always met within the project area. Fluctuations in fine sediments at depth vary with a variety of factors. While anthropogenic sources of sediment such as roads, trails, and ground disturbance from grazing, mining, and vegetation management have the potential to contribute fine sediment to streams, natural storm events and fire-related soil erosion and mass wasting can also be large contributors to instream fine sediment. These data are analyzed on multi-year trends rather than year-to-year fluctuations.

3.3.5.7. Groundwater

Limited information is available regarding groundwater resources within the project area. Large aquifers exist within the alluvial deposits of the Lemhi River, Salmon River, Pahsimeroi River, and Lost River valleys, but these areas are primarily off-Forest. Groundwater resources on National Forest System lands generally consist of isolated aquifers within alluvial deposits, as well as springs and seeps in basin headwaters. Groundwater is recharged directly from infiltration of rainfall, snowmelt, and surface streamflows. Many headwater streams are fed by groundwater, while some larger water courses such as the Lost River lose water to large aquifers in deep alluvial deposits.

3.3.5.8. Water Uses

Water uses within the project area include diversions for irrigation, small scale stockwater developments, domestic water from wells, domestic use from municipal watersheds, and small scale hydropower development. Numerous permitted diversions are located on National Forest System lands throughout the area, resulting in decreased streamflows downstream. Wells on National Forest System lands provide drinking water for campgrounds and other Forest Service facilities within the project area.

The Idaho Department of Environmental Quality has designated "Source Water Protection Areas" for waters that supply public drinking water and supply wells used for public consumption (Idaho DEQ 2014b). Source water protection areas within the project area include source waters for the communities of Salmon and Challis, as well as source waters for large private, commercial, and public uses throughout the project area. Source water protection areas for surface waters on National Forest System lands for the city of Salmon includes the Jesse Creek, Chipps Creek, and Pollard Creek watersheds, as well as a 500-foot buffer on the tributaries of the Salmon River in the Williams Creek-Salmon River and Twelvemile Creek-Salmon River 5th-level watersheds. Source water protections areas for surface waters on National Forest System lands for the city of Challis include a 500-foot buffer along Garden Creek and its tributaries. Source protection areas were also identified for numerous wells that provide consumptive water uses.

For the purpose of this analysis and to define the contributing watersheds affecting source water protection areas, watersheds were delineated at the 6th-level for all surface water source protection areas. Source protection areas for groundwater sources were delineated by a 1,000-foot radius around each well. The total area of these delineated areas on National Forest System lands is 106,053 acres. A total of 3,627 acres of invasive plant infestations occur within these delineated areas, comprising 3.4% of the total area. The majority of these infestations occur as spotted knapweed infestations along the tributaries of the Salmon River within the source water protection area for the city of Salmon. Very few invasive plant infestations have been inventoried in the Jesse Creek, Chipps Creek, and Pollard Creek source protection area (44.7 acres, or 0.4% of the watershed) or the Garden Creek source protection area (50.8 acres, or 0.5% of the watershed). Numerous invasive plant infestations are located near source water protection areas identified for wells in the North Zone near North Fork and Gibbonsville.

3.3.5.9. Landtypes and Soils

Landtype geology within the project area, in order of abundance from greatest to least, consists of volcanics (36%), quartzites (31%), granitics (17%), sedimentary rocks (13%), and alluvial deposits (3%) (Table 3-17). Landtypes are dependent on the geologic parent material. Although detailed soils data are limited on the Salmon-Challis National Forest, landtype geology provides a good indicator of soil characteristics, rock fragment content, soil texture, infiltration capacity, and erosion potential. Each of these characteristics can affect the mobility and persistence of herbicides.

Table 3-17: Existing Inventoried Invasive Plant Infestations by Landtype Parameter

	Description	Total acres	% of project area	Invasive plant infested acres	% of total invasive plant infestation	% of area infested
By Landtype Geology	Alluvium	77,612	2%	3,800	8%	5%
	Granitic	527,431	17%	11,405	23%	2%
	Mixed	13,173	0%	0	0%	0%
	Quartzite	968,020	31%	22,463	46%	2%
	Sedimentary	419,313	13%	2,351	5%	0.6%
	Volcanic	1,109,867	36%	9,134	19%	0.8%
	TOTAL	3,115,417		49,153		
By Landtype Erosion Hazard	Very High	77,292	2%	3,330	7%	4%
	High	1,714,359	55%	17,697	36%	1%
	Moderate	874,474	28%	22,744	46%	3%
	Low	449,292	14%	5,383	11%	1%
	TOTAL	3,115,417		49,153		
By Landtype* (3 highest infested)	Q120bs-1	50,871	1.6%	4,222	9%	8%
	Q120b	58,193	1.9%	2,842	6%	5%
	VB	33,690	1.1%	2,393	5%	7%

*Landtype Descriptions:
Q120bs-1: Moderately dissected mountain slopeland in quartzite, warm and dry sites
Q120b: Moderately dissected mountain slopelands in quartzite, cool and moist sites
VB: Alluvial valley bottoms including alluvial fans, terraces, and floodplains

Volcanics, located primarily in the southern half of the project area, can have high rock fragment content, but tend to also have high clay content and very fine textured soils. Quartzites, located primarily in the northern half of the project area and in most of the Lemhi Range, are more resistant to erosion, creating soils with high percentages of coarse rock fragments, moderately coarse soil textures, and high resistance to erosion. Granitics, located along the western portion of the project area, tend to decompose easily, creating soils with low percentages of rock fragments, but coarse soil texture. Sedimentary landtypes, scattered throughout the ranges on the eastern half of the project area, tend to create low percentages of rock fragments and fine soil texture.

Soil properties, particularly infiltration and organic content, influence the movement of herbicides through the soil through leaching, and the amount of herbicide that is subject to transport by runoff (Table 3-18). Infiltration rates are largely dependent on soil textures, clay content, and rock fragment content. Soils on the Salmon-Challis National Forest typically have high rock fragment content. Soils with coarse textures or high rock fragment content tend to have high infiltration rates. These soils include those within granitic and quartzite landtypes. Soils with fine textures, high clay content, and low rock fragment content tend to have lower infiltration rates. These soils include some of the volcanic and sedimentary landtypes.

Table 3-18: Comparison of Soil Properties by Landtype Geology

	Clay Content	Coarse Fragments	Infiltration	Runoff
Granitic	L	M	H	L
Quartzitic	L	H	H	L
Volcanic	M-H	M	L	H
Sedimentary	M-H	L	L-M	M-H

L = Low, M = Moderate, H = High

Almost half of the inventoried invasive plant infestations occur in quartzite landtypes, despite the fact that volcanics are the most abundant landtype geology (Table 3-17). This is primarily because of the prevalence of invasive plants in the Middle Salmon-Panther sub-basin, which is largely quartzite. Although alluvium accounts for only 2% of the project area, 8% of the inventoried invasive plant infestations occur in this landtype geology, largely because of the presence of surface water and shallow aquifers that promote plant growth. Infestations occur on 5% of all alluvial landtypes in the project area. The majority of inventoried invasive plant infestations occur in areas with moderate and high landtype erosion hazard ratings. Invasive plants are most prevalent in landtypes including moderately dissected mountain slopelands and alluvial valley bottoms.

3.3.6. Environmental Consequences

3.3.6.1. Alternative 1-No Action

Direct and Indirect Effects

General Effects

Without any additional treatments, existing invasive plant infestations are expected to spread into susceptible areas, utilizing vectors such as roads, trails, livestock, wildlife, wind, and water. Additional factors include various human uses and fire. The spread of invasive plants has been shown to occur at an average rate of 1.3 to 35% per year, based on a synthesis of data for the spread of 16 invasive plants (many of which occur on the Salmon-Challis National Forest) throughout the United States (Duncan et al. 2004, Duncan and Clark 2005). This study indicated annual rates of spread of 10 to 24% for spotted knapweed, 10 to 12% for Canada thistle, 12 to 22% for musk thistle, and 12 to 16% for leafy spurge. The actual rate of spread of invasive plants in the Salmon-Challis National Forest has not been quantified. However, based on the existing acreage of known infestations and an implied annual rate of spread of 10 to 24%, the No Action alternative could potentially result in approximately 79,000 to 144,000 acres of infestations within the project area after 5 years of no treatment and 127,000 to 422,000 acres of infestations after 10 years of no treatment.

This expansion of terrestrial invasive plant infestations into areas containing native vegetation could over time alter vegetation composition, sediment yield, soil productivity, water availability, runoff potential, and riparian function in these areas. These potential changes are discussed in the following sections in relation to the established measurement indicators.

Currently, no infestations of aquatic invasive plants occur within the project area. However, the potential exists for one or more aquatic invasive plant species to move into this area. Without an effective control method (such as the use of aquatic herbicides), the general effects of this occurring could be severe, depending on the characteristics of the water body. Invasion of Eurasian water milfoil, which can quickly outcompete native aquatic vegetation, is considered to be one of the most serious aquatic invasive plant issues in the Northwest. Under the No Action alternative, impacts to water chemistry could include decreased dissolved oxygen, increased nutrient loading (nitrogen and phosphorus), altered biomass turnover, changes in water temperature, and increased turbidity (Parkinson et al. 2011). These effects could have impacts on aquatic habitat.

Effects on Instream Sediment Loads

Direct Effects

The No Action alternative would have no direct adverse effects on sediment input into streams or other water bodies because no ground disturbing treatments would be implemented. Mechanical invasive plant treatments, road, trail, or overland access to treatment sites, and site preparation for restoration would not occur under this alternative.

Indirect Effects

The No Action alternative would have a number of indirect effects related to erosion and sediment input into streams or other water bodies. These short-term effects would gradually increase in severity as a result of changes in ground cover composition caused by invasive plant infestation and the loss of native ground cover.

Numerous studies have shown sediment yields to increase as a result of the establishment of invasive plant species such as spotted knapweed and sulfur cinquefoil. Conversion of native bunchgrasses to these invasive plants causes groundcover to become more sparse. In a controlled experiment on moderate slopes in Western Montana, Lacey et al. (1989) measured a 56% increase in runoff and a 192% increase in sediment yield on knapweed-infested slopes as compared to slopes dominated by bunchgrass. Similarly, a 5 times increase in sediment yield was measured by Hickenbottom on a site in Western Montana with 80% knapweed cover compared to a site covered with bunchgrass (USDA Lolo NF 2007). These studies suggest that the conversion of bunchgrasses to spotted knapweed is detrimental to the objectives of protecting topsoil. Lacey et al. (1989) showed that a decrease in groundcover also resulted in decreased infiltration and increased hillslope runoff. Increased runoff can further contribute to increased erosion, soil loss, and sediment input to streams.

Much of the proposed project area consists of moderate to steep, arid slopes. Because native vegetation such as bunchgrass is vital to stabilizing soils on steep slopes such as along the Salmon River Breaks, these areas are susceptible to increased sediment yield as a result of invasive plant infestations. Soil loss on steep slopes with thin soils could cause permanent alterations that may not be recoverable.

Increased sediment yield from invasive plant infested hillslopes in the project area could result in increased turbidity and sediment loads in stream channels. The amount of sediment reaching stream channels from these hillslopes would be limited by sediment capture within functional riparian buffers and other impoundments, but could be enough in some places to cause streams to exceed fine sediment standards in the long term after the extensive spread of invasive plants. Increased fine sediments in streams can cause sediment deposition and channel aggradation, which can result in decreased pool depths, increased channel widths, decreased channel stability, and bank erosion. These processes can degrade spawning and rearing habitat for fish.

On a watershed scale, increased runoff and peak flows caused by decreased groundcover and infiltration as a result of invasive plant infestation (Lacey et al. 1989) can result in additional stream channel instability. Invasive plant infestations in riparian areas can also result in the loss of woody riparian vegetation species, which function to maintain bank stability. This loss of woody root structure can cause increased rates of bank erosion and sediment delivery to stream channels (refer to Effects on Riparian Function, below).

These indirect effects occur presently to a limited extent, and the severity of these effects would increase gradually with the spread of invasive plants throughout the project area. The magnitude of these effects is likely to be the greatest where large, landscape-scale infestations occur, rather than small, scattered infestations. Unmanaged, small scattered infestations expand to large landscape level infestations. It is likely that in heavily infested watersheds, increased sediment loads as a result of invasive plant infestation would be detectable at established watershed monitoring sites in the long term (>10 years). In some severely impacted watersheds, the spread of invasive plants could contribute to exceedances of Forest Plan and PACFISH/INFISH standards for instream fine sediments.

Watershed Scenarios

The Spring Creek Watershed, located west of North Fork, Idaho, drains an area of 12,100 acres. Infestations of spotted knapweed have been inventoried on 1,074 acres (9% of the watershed), and many of these infestations occur on slopes once dominated by bunchgrass. Based on the three-fold increase in sediment yield measured by Lacy et al. (1989) on similar slopes, current conditions could represent an estimated 18% increase in basin-wide sediment production compared to historic conditions with no knapweed present. Given a 10 to 24% rate of annual spread of spotted knapweed (Duncan et al. 2004), total sediment production could increase 29 to 52% after 5 years of spread, and 46 to 153% after 10 years of spread (Table 3-19). This likely overestimates sediment production, because the spread of spotted knapweed would occur on different slope gradients and cover types, some of which are less susceptible to increased sediment yields. However, it does provide an indication of the effects that could occur on a watershed scale.

Table 3-19: Sediment Yield Scenario from the Spread of Spotted Knapweed in the Spring Creek Watershed

	Spotted knapweed infested acres	Percent of watershed infested	Percent increase in basin sediment production[2]
Present	1,074	9%	18%
After 5 years of spread[1]	1,730 - 3,149	14 to 26%	29 to 52%
After 10 years of spread[1]	2,786 - 9,230	23 to 76%	46 to 153%

1 Based on estimated 10 to 24% rate of annual spread.
2 Based on estimated 200% increase in sediment yield on slopes infested with spotted knapweed (Lacy et al. 1989).

Hillslope Scenarios

Increased sediment yield as a result of invasive plant infestation was modeled using Disturbed WEPP (Elliot and Hall 2010). Under this scenario, a spotted knapweed infestation spreads onto previously uninfested hillslopes near North Fork, Idaho. Prior to infestation (year -1), the percent ground cover was approximately 60%. By year 5, vegetation on the slopes has transitioned from a native bunchgrass community to a monotypic stand of spotted knapweed. At this point, the percent ground cover is reduced to approximately 20%, with soil loss and compaction similar to the “skid trail” condition described in Disturbed WEPP (Elliot and Hall 2010). Modeling was run based on 50 years of climate modeling (Table 3-20).

Table 3-20: Input Parameters and Results of Disturbed WEPP Modeling of Erosion from Two Hypothetical Knapweed-infested Hillslopes near North Fork, Idaho.

Hillslope #1: 60% slope, sandy loam, no buffer		Year 1	Year 3	Year 5
Upper Slope	Gradient (top/mid)	60% / 60%	60% / 60%	60%/60%
	Horizontal Length	500 ft.	500ft	500ft
	Vegetation/Treatment	Good Grass	Poor Grass	Skid Trail
	Percent Cover	60%	40%	20%
	Percent Rock	20%	20%	20%
Lower Slope	Gradient (top/mid)	30% / 30%	30% / 30%	30% /30%
	Horizontal Length	100 ft.	100 ft.	100 ft.
	Vegetation/Treatment	Good Grass	Poor Grass	Skid Trail
	Percent Cover	60%	40%	20%
	Percent Rock	20%	20%	20%
Results	Probability of erosion	2%	4%	18%
	Erosion rate (tons/acre): 10-year Return Period	0.00	0.00	0.83
	Probability of sediment delivery	2%	4%	18%
	Sed. delivery (tons/acre): 10-year Return Period	0.00	0.00	0.83

Hillslope #2: 60% slope, sandy loam, 100-foot/30% buffer		Year 1	Year 3	Year 5
Upper Slope	Gradient (top/mid)	60% / 60%	60% / 60%	60%/60%
	Horizontal Length	500 ft.	500 ft.	500 ft.
	Vegetation/Treatment	Good Grass	Poor Grass	Skid Trail
	Percent Cover	60%	40%	20%
	Percent Rock	20%	20%	20%
Lower Slope	Gradient (top/mid)	30% / 30%	30% / 30%	30% / 30%
	Horizontal Length	100 ft.	100 ft.	100 ft.
	Vegetation/Treatment	Shrubs	Shrubs	Shrubs
	Percent Cover	80%	80%	80%
	Percent Rock	20%	20%	20%
Results	Probability of erosion	2%	2%	18%
	Erosion rate (tons/acre): 10-year Return Period	0.00	0.00	0.69
	Probability of sediment delivery	2%	2%	18%
	Sed. delivery (tons/acre): 10-year Return Period	0.00	0.00	0.0017

Assuming no change in soil type (sandy loam) or rock fragment content (20%), this modeling suggests that the change in groundcover related to invasive plant infestation would result in a considerable increase in erosion rate and sediment delivery after a period of 5 years. While a hillslope of native bunchgrass would not likely result in any measurable erosion or sediment delivery at the 10 percent exceedance level (i.e. from a storm with a 10-year recurrence interval), the same hillslope impacted by an expansive infestation of knapweed could experience 0.83 tons per acre of sediment delivery during the same storm for a hillslope with not buffer, and 0.0017 tons per acre for acre for a hilllslope with a 100-foot riparian buffer at the base of the slope. Although the accuracy

of these predicted erosion rates is plus or minus 50% at best (Elliot and Hall 2010), this modeling provides a sense of the changes that could occur.

Effects on Herbicide Concentrations in Water

The No Action Alternative would have no direct or indirect adverse effects on concentrations of herbicides in streams, other surface waters, groundwater, or drinking water sources because no chemical invasive plant treatments would be implemented. If present, concentrations of any residual herbicides currently in the environment from past treatments would decrease over time under the No Action Alternative.

Effects on Riparian Function

Direct Effects

The No Action alternative would have no direct adverse effects on the condition of riparian areas within the project area because no ground disturbing treatments would be implemented. Mechanical invasive plant treatments, road, trail, or overland access to treatment sites, and site preparation for restoration would not occur under this alternative.

Indirect Effects

The No Action alternative would have a number of indirect effects on the condition of riparian areas within the project area. Native woody riparian shrubs provide an essential function within riparian areas, particularly in lower gradient streams, because their roots provide structure and stability to stream banks. Loss of this native riparian vegetation to invasive plant species that do not provide this woody root structure has the potential to cause decreased bank stability and increased bank erosion in some channel types, which in turn can lead to channel widening, channel instability, and increased sediment loads (Polvi et al. 2014). Additional indirect effects related to the loss of native riparian vegetation could include channel widening, filling of pools, increased fine bed sediments, decreased large woody debris recruitment, loss of aquatic habitat, decreased shading of streams, and increased stream temperatures. These effects would occur on a continual basis over the long term (>10 years), with gradually increasing severity as the extent of invasive plant infestation in riparian areas increases.

Colonization of riparian areas with invasive plants has resulted in dramatic effects in many parts of the United States. The invasion of salt cedar along rivers and streams of the western United States has in some places resulted in almost complete loss of native willow vegetation, affecting water availability, soil properties, channel morphology, and numerous other ecological processes (Urgenson 2006). While salt cedar is present, but not prevalent within the project area (4 infestations covering 0.5 acres), it has the potential to spread further into this area and displace native riparian vegetation. Japanese knotweed has invaded riparian forests in the Pacific Northwest, altering the composition of the forest and understory, which in turn affects stream bank stability, channel morphology, and nutrient dynamics (Dawson and Holland 1999; Urgenson 2006). Knotweed has been shown to outcompete native juvenile trees, affecting the riparian forest succession over time, thereby decreasing root strength that provides bank stability and inputs of large woody debris to the channel (Urgenson 2006). Although knotweed is currently present in only 6 infestations covering 0.9 acres within the project area, it has the potential to spread further into the area.

Riparian areas can be highly susceptible to colonization by non-native plants, as a result of regular disturbance regimes (flooding, erosion, deposition, drought, human and animal sources), availability of water and nutrients, and habitat connectivity (Planty-Tabacchi et al. 1996; Urgenson 2006). Under certain conditions, small infestations of invasive plants could spread rapidly and dramatically change the function of a riparian area in a short period of time (less than 5 years). However, functional riparian areas are characterized by a high diversity in not only species, but also physical processes which allows for high species diversity and heterogeneous morphology (Schmitz and Jacobs 2007). A review of literature suggests that many invasive plant infestations in riparian areas are largely the result of flow alterations, such as reduction in peak flows downstream of dams, which prevent the natural disturbance regime that allows native plant diversity to occur. For example, widespread infestation of salt cedar on regulated southwestern rivers are essentially adapted to altered flow regimes, while native willows cannot compete under these conditions. Studies have suggested that restoration of a natural flow regime is the only way to restore native plant communities in these altered riparian ecosystems (Junk et al. 1989; Poff et al. 1997; Schmitz and Jacobs 2007). Large scale flow alterations do not generally occur within the project area. However, flow reductions related to diversions, as well as prolonged periods of drought are likely to result in higher susceptibility to invasive plant infestations in some riparian systems.

Existing invasive plant infestations are likely to expand in the project area with no treatments under the No Action alternative. Duncan et al. (2004) cited average annual rates of spread of 1.3 to 35% per year for a variety of invasive plants. Under the No Action alternative, the rate of spread in healthy, functional riparian areas is likely to be at the low end of that range. However, the rate of spread would likely be higher in riparian areas that are impacted by stressors such as flow reduction from diversions upstream or prolonged drought, livestock use, fire, or a variety of human uses. Because natural conditions are generally well protected within riparian areas in the project area as a result of PACFISH/INFISH RMOs and other BMPs, and extreme flow alterations are limited, the annual rate of expansion in riparian areas would be relatively low. Based on the existing acreage of known infestations within RHCAs and an estimated annual rate of expansion of 5 to 15%, the extent of invasive plant infestation within RHCAs could increase to approximately 20,100 to 31,700 acres after 5 years of no treatment (5.0 to 7.9% of all RHCA acreage) and 25,700 to 63,800 acres after 10 years of no treatment (6.4 to 16.0% of all RHCA acreage). This could result in areas of detrimental changes to riparian character and function in the long term. The most severe indirect stream channel effects would likely occur in unconfined, low gradient, meandering stream channels with wide floodplains, where riparian vegetation provides a large influence on channel form.

Effects on Soil Condition

Direct Effects

The No Action alternative would have no direct adverse effects on soil condition because no ground disturbing treatments would be implemented. Mechanical invasive plant treatments, road, trail, or overland access to treatment sites, and site preparation for restoration would not occur under this alternative.

Indirect Effects

The following indirect effects of the No Action alternative on soil condition are likely to occur with gradually increasing severity as native plant species are displaced by invasive plants. These effects would generally occur in the long term.

Soil Erosion: The effects of invasive plants on sediment yields from slope erosion and soil loss are discussed in Effects to Instream Sediment Loads. Under conditions with high prevalence of invasive plant species, displacement of native species, erodible soils, limited ground cover, and steep topography, the increase in soil erosion after 5 or more years of no treatment is likely to be moderate to high. Increased soil erosion rates have been shown to decrease soil productivity (Lacy et al. 1989). Many soils within the project area are thin, particularly on moderate and steep slopes. Loss of stabilizing plant cover such as native bunchgrasses to invasive plant such as knapweed that have a much sparser growing pattern leads to a high risk of soil loss. In areas of high and very high erosion hazard rating, soil lost in this manner may not be recovered. Invasive plant infestations are likely to cause limited or no increase in soil erosion rates on low gradient slopes. Soil erosion would likely increase in infested riparian areas as a result of increased bank erosion and channel instability.

Organic Material: Invasive plant infestations in grasslands can result in decreased organic material in the soil. This is directly related to increased soil erosion, which tends to remove the organic material first. Loss of organic material is also related to the deeper root structures associated with some invasive species, the decreased input of organic material by invasive plants, and compounds within invasive plants that can slow decomposition rates (Olson 1999). However, these effects vary by species.

Soil Mechanics: Invasive plants can affect soil mechanics in a number of ways. Sparse groundcover, decreased organic material, and soil crusting can lead to reduced infiltration rates and increased runoff and peak flows (Lacey et al. 1989; Olson 1999). Decreased groundcover, such as that seen in spotted knapweed infestations, can also result in increased evaporation rates, thereby reducing the availability of water in the soil. Different species can exploit water in various ways through root structure and timing, thereby outcompeting native plants (Olson 1999). All of these factors can also lead to greater fluctuations in soil temperature (Olson 1999), which can also contribute to unfavorable conditions for native vegetation.

Soil Nutrients and Chemistry: Invasive plant infestations can result in depletion of soil nutrients and changes in soil chemistry. Invasive plants tend to have higher rates of nutrient uptake than native plants, as well as slower rates of root decomposition (Olson 1999). A spotted knapweed infested site resulted in reductions of 44% in potassium, 62% in nitrogen, and 88% in phosphorus compared to adjacent soils colonized by native grasses in a study conducted by Harvey and Nowierski (Olson 1999). Non-native plants can tolerate these soil conditions and also exploit any available nutrients, thereby outcompeting native plants (Olson 1999). Many invasive plant infestations can also increase soil pH, extractable nitrate, net nitrogen mineralization (Weidenhamer and Callaway2010). Additional effects may include changes to mycorrhizal fungus communities. Tyser (1992) described severe reductions in cryptogamic soil crusts as a result of a knapweed infestation.

Soil Microbes: Most invasive plant species produce secondary compounds, which can affect the diversity and abundance of soil microbial populations and mycorrhizal associations (Weidenhamer and Callaway 2010). Decreased abundance of soil microbes can result in decreased decomposition rates and slower rates of nutrient cycling (Olson 1999). Spotted knapweed is known to contain toxic secondary compounds, which negatively affect other plants, soil microbes, and their interactions (Alford et al. 2009).

Many of the effects described above are currently taking place to some extent within the larger infestations that exist in the project area. Without aggressive intervention, soils within large infestations of knapweed are not likely to return to their "pre-infestation" conditions that would allow them to support native grasses. Under the No Action alternative, the spread of smaller infestations into areas that do not currently contain invasive plant species would likely result in more widespread changes to soil condition in the long term. Because soil condition indirectly affects nearly all watershed processes, these changes to upland soils could have gradual, but far reaching impacts on streamflows, stream channel condition, riparian areas, and habitat in the long term (>10 years).

Cumulative Effects

Analysis Approach for All Alternatives

The analysis area considered for this cumulative effects analysis includes the eleven 4th-level watersheds covered by the project area (Table 3-13). The percentage of each 4th-level watershed covered by the project area ranges from 0.3% to 79% (Table 3-21). The project area covers less than 5% of three of these watersheds.

Table 3-21: Land Ownership Percentages within 4th-level Watersheds Intersecting the Project Area.

4th-level Watershed	Percent within project area (mostly SCNF)	Outside of Project Area		
		Percent other USFS	Percent BLM	Percent State, City, Private, Other
17040216 Birch	1.2	37.7	40.9	20.2
17040217 Little Lost	43.5	0.1	43.6	12.8
17040218 Big Lost	34.5	0	29.0	36.5
17040221 Little Wood	0.3	8.9	45.8	45.0
17060201 Upper Salmon River	34.5	35.3	24.5	5.6
17060202 Pahsimeroi	46.5	0	41.4	12.1
17060203 Middle Salmon-Panther	79.3	5.6	10.6	4.5
17060204 Lemhi	40.2	0.1	38.5	21.2
17060205 Upper Middle Fork Salmon	11.9	87.9	0	0.2
17060206 Lower Middle Fork Salmon	12.8	86.7	0	0.5
17060207 Middle Salmon-Chamberlain	3.6	94.8	1.0	0.6

Cumulative Effects of Treatments

Numerous activities within the project area (Appendix H) may affect soil and water resources. Ongoing and foreseeable future activities and influences on these resources within the cumulative effects analysis area fall into four categories: Forest Service management activities, uses on Forest Service lands, natural processes, and activities on non-National Forest lands. The cumulative effects of each alternative are analyzed qualitatively by considering the direct and indirect effects of each invasive plant control method under each alternative in addition to these activities.

Forest Service Management Activities: Forest Service management activities that can potentially affect soil and water resources include timber sales, vegetation management projects, instream

restoration projects, road maintenance and decommissioning, and culvert replacement projects. These projects are managed to have minimal impacts on soil and water resources through the use of BMPs and other protective measures such as PACFISH/INFISH RMOs. These projects would maintain water quality and maintain desired condition within the project area. Any short term adverse effects resulting from these projects would generally be overshadowed by long term beneficial effects.

Uses on Forest Service Lands: Uses on Forest Service lands that can potentially affect soil and water resources in the project area include administrative uses, cattle grazing, mining, and recreation. The impacts of these uses are also managed to have minimal impacts on soil and water resources through design criteria and BMPs implemented through special use permitting and approval of mining plans of operations.

Implementation of the Travel Plan, restricting motorized use to designated routes only, minimizes impacts to soil and water resources from off-road travel.

Natural Processes: Numerous natural processes will continue to affect soil and water resources, but within the range of natural variability. Wildfire is likely the largest factor impacting soil and water condition, often causing major impacts to water quality, stream channel function, soil erosion, and riparian vegetation.

Activities on Non-National Forest lands: Numerous impacts to soil and water resources occur on private, state, and other federal lands, including residential and industrial development, ranching, and extensive road systems. Many of these impacts result in large areas of soil exposure and increased erosion.

Cumulative Effects of Invasive Plants on Watershed Condition

On the scale of the 6th-level watershed (sub-watershed), the cumulative effects of the long term spread of invasive plants in addition to other ongoing management activities and uses could potentially result in degradation of watershed condition. This cumulative effects analysis utilizes the Watershed Condition Framework, a Forest Service model for classifying watershed condition (USDA Forest Service 2011b). This framework identifies 12 indicators, with one to four attributes under each indicator, to assess watershed condition based on aquatic physical, aquatic biological, terrestrial physical, and terrestrial biological processes (Table 3-22).

Table 3-22: Indicators and attributes analyzed under the Watershed Condition Framework

Category	Indicator	Attribute
Aquatic Physical (30%)	Water Quality	*Impaired Waters (303d listed)
		*Water Quality Problems (not listed)
	Water Quantity	Flow Characteristics
	Aquatic Habitat	Habitat Fragmentation
		Large Woody Debris
		*Channel Shape and Function
Aquatic Biological (30%)	Aquatic Biota	Life Form Presence
		Native Species
		Exotic and/or Invasive Species
	Riparian/Wetland Vegetation	*Vegetation Condition
Terrestrial Physical (30%)	Roads and Trails	Open Road Density
		Road Maintenance
		Proximity to Water
		Mass Wasting
	Soils	*Soil Productivity
		*Soil Erosion
		Soil Contamination
Terrestrial Biological (10%)	Fire Regime or Wildfire	Fire Condition Class OR Wildfire Effects
	Forest Cover	Loss of Forest Cover
	Rangeland Vegetation	*Vegetation Condition
	Terrestrial Invasive Species	*Extent and Rate of Spread
	Forest Health	Insects and Disease
		Ozone

*Indicates attributes that may be affected by the spread of invasive plants.

Sixth-level watersheds are classified as functioning properly (Class 1), functioning at risk (Class 2), or impaired function (Class 3). The Watershed Condition Framework considers only National Forest System lands within a watershed. A total of 162 watersheds within the project area were rated as Class 1, 33 watersheds were rated as Class 2, and no watersheds were rated as Class 3 under the Watershed Condition Framework in 2011.

The spread of invasive plants could potentially affect ratings for eight of these attributes, including Impaired Waters, Water Quality Problems, Channel Shape and Function, Riparian Vegetation Condition, Soil Productivity, Soil Erosion, Rangeland Vegetation Condition, and Extent and Rate of Spread (of terrestrial invasive species). The Watershed Condition Framework also takes into consideration a number of indicators representing disturbance or vectors that may accelerate the spread of invasive plants, such as road networks, fire susceptibility, and streamflow characteristics.

Watersheds with the highest risk of cumulative effects are those with an impaired condition class and a high percentage of the watershed covered by existing infestations. These watersheds represent areas where management activities, Forest uses, and other impacts are most likely to occur, and where the widespread presence and long term spread of invasive plants is most likely to result in cumulative effects to watershed condition in combination with these activities, uses, and impacts.

The risk of cumulative effects related to invasive plants is categorized for each sub-watershed under each alternative as low, moderate, or high, based on matrices for each alternative that consider watershed condition class and the percentage of the watershed covered by existing infestations.

Values in the matrices were developed using professional judgment and considering the expected response of invasive plants under each alternative. The percentage of invasive plant infested acres was broken into five categories used in the matrices: less than 1%, 1 to 5%, 5 to 10%, 10 to 25%, and greater than 25%. These breaks are based on the condition rating rule set for the Terrestrial Invasive Species Condition attribute in the Watershed Condition Framework, where a "functioning properly" condition is defined by less than 10 percent invasive plant infested acres, a "functioning at risk" condition is defined as 10 to 25 percent infested acres, and an "impaired function" condition is defined by greater than 25 percent infested acres (USDA Forest Service 2011b).

Cumulative Effects of Invasive Plant Treatments

Under the No Action alternative, no invasive plant treatments would occur on National Forest System lands within the project area. However, chemical invasive plant treatments would continue on private, state, and county lands within the 4th-level watersheds of the project area. This alternative would result in no cumulative effects related to the direct or indirect effects of treating invasive plants.

Cumulative Effects of Invasive Plant Infestations

The indirect effects of the No Action alternative on soil and water resources were identified as long-term, gradually increasing effects related to decreased groundcover, increased runoff, soil loss, and loss of riparian vegetation. Cumulative effects of these indirect effects could occur in addition to other ongoing and foreseeable future activities, as described below:

Forest Service Management Activities: The potential cumulative effects of the No Action alternative in addition to the effects of ongoing and reasonably foreseeable Forest Service management activities would result in the gradual degradation of watershed condition over time in the long term, where invasive plant infestations occur or are expected to occur. The effects of the spread of invasive plants through the project area would occur in the long term, while most effects occurring from Forest Service management activities would occur in the short term, but on a continual basis. The continued spread of invasive plants in the project area would make it more difficult to maintain desired condition during the implementation of other projects such as timber sales or vegetation treatments. For example, reclamation following a vegetation improvement project would not be as effective in controlling erosion risk and sediment production if invasive plants are already present, preventing adequate native vegetation re-establishment.

Uses on Forest Service Lands: The spread of invasive plants would make management of ongoing uses on National Forest system lands more difficult. For example, the ability to adequately manage grazing in riparian areas would decline with the spread of invasive species. In this case, invasive plants would make stream banks less resilient to the effects of hoof shear and other grazing impacts, resulting in cumulative effects if grazing were to continue.

Natural Processes: The continued spread of invasive plants within the project area would also have cumulative effects when considered in addition to natural sources of soil and water impairment such as wildfire. In the case of fire, recovery from fire would not occur as effectively or as quickly as it would if no invasive plants were present in the area. Following a fire, if invasive plant are already present in an area, invasive plants would be more likely to colonize burned areas, preventing re-establishment of native species and doing little to control erosion rates. In this

situation, fine sediments would persist in streams longer following a fire than in a situation where native vegetation quickly became re-established.

Activities on Non-National Forest lands: The indirect effects of the No Action alternative on soil and water resources on Forest Service lands would be relatively minor compared to the effects associated with the spread of invasive plant as well as the widespread ground-disturbing activities that occur on much of the non-Forest Service lands in the analysis area.

A matrix was developed to assess the level of risk of cumulative effects for the No Action alternative based on watershed condition class and the percentage of the watershed currently infested by invasive plants (Table 3-23). Based on the expected rates of spread as discussed in the No Action alternative General Effects, watersheds with less than 1% infested acres would generally be low risk. Watersheds with 1 to 5% infested acres would represent a moderate risk of cumulative effects in class 2 watersheds because it is possible that the spread of invasive plants would approach the "functioning at risk" threshold of 10% and interact negatively with other activities occurring in the watershed. Watersheds with 5 to 10% infested acres would likely exceed the 10% threshold in the long term and have adverse cumulative effects. Any watershed with over 10% infested acres would likely have adverse cumulative effects in the long term as a result of the rapid spread of invasive plant infestations.

Table 3-23: Long Term Cumulative Effects Risk Matrix for Sixth-level Watersheds for the No Action Alternative

		Percent of Watershed Infested by invasive plants				
		<1%	1-5%	5-10%	10-25%	>25%
Watershed Condition Class	1	L	L	M	H	H
	2	L	M	H	H	H
	3	M	H	H	H	H

(L=low, M=moderate, H=High)

Under the No Action alternative, this analysis suggests that long term effects of the spread of invasive plants would likely result in cumulative effects in a number of 6th-level watersheds. As invasive plants continue to spread as predicted under the No Action alternative, cumulative effects would increase, leading to additional long term watershed impairment. Five watersheds have a high risk for cumulative effects and 18 watersheds have a moderate risk (Appendix N). These watersheds are located in the 'North' invasive species management zone, where infestations are most concentrated. Because the spread of invasive plants affects many of the attributes in the Watershed Condition Framework, it is possible that these cumulative effects could result in degradation of watershed condition class for watersheds with moderate or high cumulative effects risk ratings in the long term (greater than 10 years).

Summary of Effects: No Action Alternative

The No Action alternative would potentially result in long term increases in instream sediment loads, impairment of riparian function in the long term, and impairment of soil condition in the long term as a result of expansion of invasive plant infestations. This alternative would not result in any increase in herbicide concentrations in water. This alternative would result in a high risk of cumulative effects in 5 watersheds and a moderate risk in 18 watersheds.

The No Action alternative would likely result in degradation of watershed condition in the long term and potentially detectable increases in fine sediment loads in streams. These conditions could

potentially contribute to exceedances of stream channel fine sediment standards in the Forest Plans and PACFISH/INFISH, as well as potential exceedances of State water quality standards. Expansion of invasive plant infestations in riparian areas could also lead to exceedances of PACFISH/INFISH bank stability standards in the long term.

3.3.6.2. Alternative 2-Current Action

Direct and Indirect Effects

General Effects

The effectiveness of methods approved under the current management strategy for treatment of invasive plant infestations is limited. Biological controls do not act quickly and may only be effective when combined with other effective treatment methods. Manual/mechanical and rehabilitation/restoration controls are the least cost-effective methods and cannot be used to treat large infested areas. Ground-based herbicide control methods are more cost effective than manual/mechanical methods, but cannot effectively treat large infested areas. The herbicides currently approved for use provide limited options for treatment in riparian areas. Even when implemented together, the use of these methods under existing budgetary constraints is not likely to be sufficient to treat the existing infestations and prevent the further spread of invasive plants.

Under the Current Action alternative invasive plant infestations within the project area are expected to continue to spread, but the percent of annual expansion of invasive plants would be less than under the No Action alternative. The three-year average (2010-2012) annual number of acres treated is approximately 1,500 acres. This is a factor of methods available for use as well as funding available to implement these methods. With 49,153 acres of inventoried invasive plant infestations currently, in addition to an unknown number of acres of non-inventoried infestations, this level of treatment would not be able to reverse the trend even if the annual rate of expansion was only 5% (2,500 acres). The current management strategy focuses on EDRR, treating small infestations that have the potential to spread into uninfested areas, and treating larger infestations along established vectors. However, the current management strategy is not likely to be able to effectively treat large, more remote infestations using the currently approved methods.

Although aquatic invasive plants are not currently present in the project area, the potential exists for their introduction into the area. The spread of an invasive plant such as Eurasian watermilfoil could cause drastic effects on lakes over a short period of time. With limited mechanisms for controlling such an infestation under the Current Action alternative, the effects of such an infestation on water chemistry would be the same as described under the No Action alternative.

Treatment of invasive plant under the Current Action alternative would have minimal direct adverse effects on soil and water resources, largely because of the small number of acres that would be treated within the 3.1 million acre project area. Established design criteria (Appendix J), BMPs (Appendix O), and label direction for herbicide control would minimize the potential for herbicides to affect soil and water resources.

The expansion of invasive plant infestations into areas containing native vegetation could over time drastically alter vegetation composition, having indirect effects on sediment yield, soil productivity, water availability, runoff potential, and riparian function in these areas. Impacts would be concentrated where vectors allow the spread of invasive species. However, some vectors such as

wind can affect large areas. Because treatments under the Current Action alternative would limit the spread of some new infestations and potentially decrease the severity of some existing infestations, the effects described above would be less severe and would occur over a longer time frame than those described under the No Action alternative. These potential effects are discussed in terms of the established measurement indicators in the following sections.

Effects on Instream Sediment Loads

Direct Effects

Under the Current Action alternative, direct effects on sediment yield caused by the implementation of invasive plant treatments would be minimal and would not likely have any measureable effect on basin sediment yields. Biological control treatments would have no direct effects on sediment, because no ground disturbance would occur during implementation. Manual/mechanical, herbicide, and rehabilitation/restoration control methods would all have minimal direct effects on sediment production and instream sediment loads as a result of minimal ground disturbance occurring during implementation. Potential sources of erosion are discussed below.

Ground disturbance may occur in the short term as a result of on-road and off-road access using Off-Highway Vehicles (OHVs) used to transport and spray herbicides. However, because these activities do not require repetitive travel over the same route, it is unlikely that vegetation or the duff layer would be highly disturbed such that erosion would occur.

Manual and mechanical treatments such as hand pulling can cause localized ground disturbance in the short term. These treatments would occur on relatively few acres in scattered locations throughout the project area because more cost-effective methods are often available (e.g. herbicide control), especially for larger infestations. Although minimal localized short term effects could occur, the desired result of these activities is re-establishment of native species, which would reduce erosion in the long term.

Rehabilitation and restoration treatments using hand tools or larger equipment such as OHV-driven harrows would result in short term ground disturbance across larger areas where extensive infestation has occurred. This could potentially result in increased sediment delivery in the short term. These treatments would typically be implemented on low gradient slopes (less than 45%), where erosion hazards are low. Recovery of native vegetation on these types of impacted slopes is likely to be slow, requiring less than 5 years for grass and forb communities, and more than 5 years for shrub/sagebrush communities. These methods have the greatest potential for short term ground disturbance, but the effects of these treatments on instream sediment loads would likely be minimal. Harrowing would result in a very shallow depth of ground disturbance, and rates of erosion from low gradient slopes would be low. However, the soils in these areas would already be subject to decreased ground cover, soil impacts, and increased erosion as a result of invasive plant infestation. The desired result would be the reestablishment of native vegetation, which would reduce erosion in the long term.

Indirect Effects

The Current Action alternative would have a number of indirect effects related to erosion and sediment input into streams or other water bodies. Under this alternative, invasive plant infestations are expected to spread, despite efforts to eliminate them. Effects related to sediment would occur as a result of changes in ground cover composition caused by the spread of invasive

plants and subsequent loss of native ground cover, as described under the No Action alternative. Invasive plant management would focus on the highest priority areas and the prevention of the spread of new infestations into uninfested areas. Large existing infestations are less likely to be treated using methods available under this alternative, and these areas would continue to be sources of erosion and sediment production. Because the rate of spread of infestations would be less than under the No Action alternative, the magnitude of these effects would be less than under the No Action alternative. However, over time these effects could potentially result in measurable changes in basin sediment yield in the long term (more than 10 years).

The use of herbicides to treat invasive plants under the Current Action alternative could result in increased soil exposure and erosion potential in the short term as a result of vegetation mortality. However, because herbicide treatments under this alternative would be limited to localized ground-based spot and broadcast applications, mortality of non-target species would be limited, and these treatments would not result in large areas of increased soil exposure. Increased soil exposure could occur in small areas, particularly in monotypic stands of invasive plants where broadcast application occurs. The 50-foot buffer requirements from flowing water and ponded water bodies for broadcast application would help to minimize any effects of soil exposure causing sediment to reach water in the short term. Reestablishment of native vegetation in treated areas would result in an overall reduction in sediment yield from these slopes in the long term.

Effects on Herbicide Concentrations in Water

The chemical treatments that would be used under the Current Action alternative include only ground-based spot and broadcast applications. As a result of the NMFS BO limiting herbicide application to 5,500 acres applied annually (USDC NMFS 2012), a very small percentage of the project area would be treated annually using these methods (0.18% based on applied acres, or 0.44% based on treated acres). Ten herbicides are currently available for upland use under this alternative, and eight of these herbicides are available for use in riparian areas (Table 2-4 and Table 2-2).

Direct Effects

Biological, manual/mechanical, and rehabilitation/restoration control methods would have no direct effects on the concentrations of herbicides in water because no herbicides would be applied using these methods.

Herbicide applications under this alternative have the potential to directly affect concentrations of herbicide in surface water and groundwater, depending on a number of factors including the type of herbicide, the amount of herbicide applied, the size of the treatment area, proximity of the application to water, the characteristics of the water body, soil characteristics such as infiltration, environmental factors such as rainfall, runoff, and wind, and chemical properties of the herbicides as they interact with soil. This section provides a discussion of herbicide properties, pathways to water, and environmental factors influencing herbicide delivery.

Herbicide Properties

Forest Service Risk Assessments have been completed by Syracuse Environmental Research Associates, Inc. (SERA) for all herbicides proposed under this alternative (SERA 2004a, 2004b, 2004c, 2004d, 2004e, 2004f, 2006, 2011a, 2011c, 2011d). These risk assessments provide detailed information about the toxicity and environmental fate of each herbicide. Information from these

risk assessments and from Tu et al. (2001) regarding herbicide behavior in soil and water is referenced in Table 3-24 and summarized below.

2,4-D Amine: 2,4-D amine is a selective systemic herbicide used to control broadleaf invasive plants. 2,4-D amine has generally lower toxicity than 2,4-D ester. This herbicide has a short half-life and is highly volatile. Water solubility and persistence in the water column is dependent on the pH of water. 2,4-D is most likely to persist in waters with low pH, allowing it to adsorb to particles in the water column. The primary mechanism of degradation in soils is from microbial activity, while degradation from ultraviolet light is limited. The environmental fate of 2,4-D in soils is dependent on the pH, microbial population, soil moisture, and temperature. Rates of degradation are highest in warm, moist, high organic soils, which favor microbial populations. 2,4-D does not readily bind to soils, and therefore has the potential to leach through soils and move off-site. However, the short half-life of 2,4-D prevents extensive leaching.

Chlorsulfuron: Chlorsulfuron is used for pre-emergent and early post emergent control of broadleaf invasive plants. This herbicide is relatively soluble, with solubility increasing with ph. Because it is weakly adsorbed by soil particles, chlorsulfuron can be highly mobile in soils and has a high leaching potential in permeable soils, leading to some potential for groundwater contamination. Degradation in soils occurs by microbial activity, which occurs more quickly under warm, moist, low pH conditions. Degradation in water occurs through hydrolysis and photolysis. The persistence of chlorsulfuron is likely to be the greatest in alkaline soils under dry conditions.

Clopyralid: Clopyralid is a selective herbicide for control of broadleaf plants. This herbicide is characterized by high water solubility, low adsorption to soil particles, and high persistence (half-life). As a result, clopyralid can be highly mobile. Degradation in soils occurs through microbial activity, with the highest degradation rates occurring in warm, moist soils that favor microbial populations. Degradation from sunlight or hydrolysis is very slow. Persistence in water can be high, as it will not generally bind with particles in the water column and it is stable over a range of pH from 5 to 9. Concern for water contamination is high because it does not bind tightly with soil particles and can potentially leach into groundwater. Clopyralid is likely to move off-site via percolation on sand and loam soils, and via runoff on clay soils.

Dicamba: Dicamba is a selective herbicide used for control of broadleaf invasive plants and woody vegetation. This herbicide is highly soluble in water, and because of its low sorption coefficient, it is highly mobile in soils. The potential for leaching in permeable soils is high, and the potential for groundwater contamination exists. Dicamba is moderately persistent in soil. Breakdown in soils occurs through microbial activity and occurs more quickly under conditions with higher temperature, higher moisture, and high organic content. Dicamba is not highly persistent in water. Breakdown in water occurs through microbial activity and photolysis.

Glyphosate: Glyphosate is a broad spectrum, non-selective, systemic herbicide. This herbicide is characterized by high solubility in water and strong adsorption to soil particles. In water, glyphosate dissipates rapidly because it adsorbs to soil and sediment particles. In soils, it becomes strongly adsorbed to soil particles, and the potential for leaching is very low. Glyphosate is degraded primarily through microbial activity. Ultraviolet and chemical degradation processes are slow. Glyphosate is unlikely to be transported to surface water via runoff, although it can be mobilized if the soil particles are also mobilized.

Imazapic: Imazapic is a selective herbicide used to control some grasses and some broadleaf plants. This herbicide is characterized by high solubility in water and moderate adsorption to soils, dependent on soil pH and organic content. Mobility in soils is limited, and it is unlikely to be mobilized by runoff. Persistence in soils is moderate, with microbial activity as the primary mechanism of degradation. However, persistence in water is very short, as it is rapidly degraded by sunlight in water.

Metsulfuron-methyl: Metsulfuron-methyl is a selective herbicide for pre- and post-emergence control of many invasive plants and woody plants. This herbicide is relatively soluble, with solubility increasing with ph. Metsulfuron-methyl is highly mobile, with high leachability in permeable soils. The potential for groundwater contamination exists. Half-lives are relatively long, and this herbicide can be highly persistent, particularly under aerobic and alkaline conditions. Breakdown in soil occurs through microbial activity under anaerobic conditions, with the rate of breakdown increasing with increased moisture and temperature. Breakdown also occurs through hydrolysis.

Picloram: Picloram is a selective herbicide used to control a variety of broadleaf plants. This herbicide is characterized by very high water solubility and low sorption coefficient. Picloram does not bind strongly with soil particles and can be mobilized by water. Degradation occurs primarily through microbial activity, but this occurs slowly and is dependent on soil properties. Ultraviolet light also causes degradation of picloram on surfaces. Persistence is high in soils, but short in water. Because of its high solubility, low adsorption to soils, and high persistence, picloram can be highly mobile and represents a threat to water contamination via surface or subsurface movement. The potential for leaching into groundwater is high, particularly in sandy soils.

Sulfometuron-methyl: Sulfometuron-methyl is a non-selective herbicide used for control of broadleaf invasive plants and grasses. This herbicide is relatively insoluble in water, generally stays near the soil surface, and has low leaching potential. Because of its low solubility, it is most likely to be transported along with soil particles during runoff. The persistence of sulfometuron-methyl is short, and it degrades rapidly in soil and water by microbial activity, hydrolysis, and photolysis. The fastest degradation occurs in moist, warm, acidic soils.

Triclopyr: Triclopyr is a selective herbicide used to control broadleaf plants. The formulation of triclopyr considered in this analysis is triethylamine salt (triclopyr amine). This herbicide degrades into triclopyr acid. Triethylamine salt is soluble in water, but does not generally bind to soil particles, and therefore can be mobile. Degradation occurs through microbial activity, but photolysis and hydrolysis also occur. Triethylamine salt degrades quickly in soil and water into triclopyr acid. Triclopyr acid binds moderately with soil particles, and movement in the environment is limited.

Table 3-24: Herbicide Behavior in Soil and Water, for Herbicides Proposed under the Current Action Alternative.

Herbicide (Active Ingredient)	Proposed Use [1]	Half Life in Water (days) [2]	Water Solubility (mg/L) [2]	Half Life in soil (days) [2]	Sorption Coefficient (soil K_{oc}) [2]	Pesticide Movement Rating (Leach ability)	Toxicity to soil microbes [2]	Degradation mechanisms
2,4-D amine	U,R	45	569	6.2	61.7	Moderate	Short Term	Soil microbes
Chlorsulfuron	U,R	200	27,900	37 - 168	40	High	Low	Soil microbes
Clopyralid	U,R	261	1,000	14-29	0.4 - 12.9	Mod-High	Low	Soil microbes
Dicamba	U	39	6,500	31	2.4 - 32.5	High	Low (?)	Soil microbes
Glyphosate	U,R	21	12,000	5.4	2,000 - 24,000	Low	Low	Soil microbes
Imazapic	U	30	36,000	113	112	Low	Unknown	Soil microbes
Metsulfuron-methyl	U,R	1213	2,790	120	35	High	Short Term	Soil microbes Water
Picloram	U	2.6-15	200,000	18 - 513	2.2 - 92.9	Mod-High	High	UV light Soil microbes
Sulfometuron methyl	U,R	113	300	10 - 100	78	Mod-High	Indirect> Direct	UV light Soil microbes
Triclopyr Acid (metabolite of TEA)	U,R	426	440	8 - 28.4	25 - 134	Mod-High	Short Term	Soil microbes

[1] Proposed uses: U=upland, R=Riparian
[2] Data from US Forest Service herbicide risk assessments (SERA 2004a, 2004b, 2004c, 2004d, 2004e, 2004f, 2006, 2011a, 2011c, 2011d). Values represent typical values or range used as parameters for GLEAMS modeling

Herbicide Pathways to Water

Norris et al. (1983) described five ways in which herbicides applied for invasive plant treatment can enter surface water or groundwater:

- Direct application
- Drift
- Mobilization in ephemeral streams and channels
- Overland flow
- Leaching

The potential for herbicides to enter water through ground-based spot and broadcast treatment operations by any of the above mechanisms under the Current Action alternative is low. The NMFS BO specifies that no more than 5,500 acres would have herbicide applied annually and no more than 550 of those acres would be chemically treated within 100 feet of live water (USDC NMFS 2012). Under current management, a 3-year annual average (2010-2012) of only 390 acres was applied within 100 feet of water. Design criteria (Appendix J), BMPs (Appendix O), and label direction would help to minimize any direct impacts to soil and water resources. The potential for these treatments to affect concentrations of herbicide in water is discussed below, under the context of the mechanisms suggested by Norris et al. (1983).

Direct Application

Direct application of herbicide to water under this alternative is very unlikely to occur. Most invasive plant treatments would occur a considerable distance from water. For treatments within riparian areas, mitigation measure requiring buffer widths of 15 feet from all water would apply for all herbicides except 2,4-D and glyphosate, which could be applied up to the water's edge. Only spot applications would be permitted within 50 feet of flowing water and ponded water bodies, allowing precise treatment of target plants only and leaving a minimal chance of herbicide being applied directly to nearby water bodies. Label requirements would be followed, and applications would only be performed by or under the direct supervision of licensed Idaho professional herbicide applicators, providing a high level of assurance that herbicides would be applied correctly. See Appendix E for herbicide application guidelines near water.

Drift

Drift of herbicide into water bodies is also very unlikely to occur under the Current Action alternative. Spot applications would be permitted within riparian areas, but these treatments would have very low potential for drift because herbicide would be applied directly to plants near ground level. Design criteria would also prohibit any spraying within 50 feet of water when the wind speed exceeds 5 mph, virtually eliminating the possibility of any accidental drift of herbicide into water bodies. Although ground-based broadcast spraying has a higher likelihood of causing drift, no ground-based broadcast spraying would occur within 50 feet of streams or ponded water bodies, thereby minimizing the risk of drift into water bodies.

Mobilization in Ephemeral Streams and Channels

The potential for mobilization of herbicide in ephemeral streams and channels during subsequent runoff events would be minimal under the Current Action alternative. Ground-

based spot applications could be applied in these areas, but would target specific plants. Ground-based broadcast applications would not occur within any riparian areas, but could be applied to dry ephemeral channels with no established riparian vegetation. Ephemeral channels have infrequent flow. Herbicide uptake by plants, as well as ultraviolet and microbial breakdown of herbicides applied would in many cases limit the amount of herbicide that could be mobilized by the first runoff event following application, depending on the persistence and mobility of the herbicide. An herbicide such as picloram would have the highest potential for mobilization in ephemeral stream channels because of its high solubility and persistence. The most likely scenario in which herbicide would be mobilized in ephemeral stream channels would occur if a runoff-producing rainstorm occurred immediately after application. Design criteria requiring weather forecasting to ensure no extreme precipitation events would occur immediately following application would minimize this risk.

Overland Flow

Overland flow is the most likely mechanism for herbicides to reach surface water under the Current Action alternative. Overland flow occurs when the rate of precipitation or snowmelt exceeds the rate of infiltration. Within the project area, this occurs occasionally during spring runoff and high intensity summer thunderstorms. Ground-based spot applications are designed to target specific plants, with limited application directly to the ground. Ground-based broadcast applications would result in some application of herbicide directly to the ground, but the extent of coverage would be limited. Design criteria, BMPs, and label requirements help ensure maximum efficiency of herbicide applications. Generally small infestations would be treated under this alternative, and the percentage of any watershed that is treated would be very small.

Herbicides such as clopyralid and picloram that have high water solubilities and low sorption coefficients have the greatest potential for being mobilized by overland flow (Table 3-24), while herbicides such as glyphosate with high sorption coefficients are unlikely to be mobilized by overland flow. Mobilization by overland flow is also dependent on the occurrence of rainfall, which varies spatially and temporally (refer to Climate discussion, above). Rates of herbicide uptake by plants, breakdown by soil microbes or ultraviolet light, and bonding with soil particles vary by herbicide. In most cases, levels of remaining herbicide would be very small by the time the first runoff occurs after treatment. Mitigation measures specifying that no herbicide application would occur if rain is forecast immediately after treatment decreases the potential for herbicide mobilization from runoff. However, herbicides with long persistence in soil, such as picloram, have the potential to be mobilized by overland flow occurring weeks or even months after application. It is also important to note that herbicide concentrations in runoff would be diluted in most situations because of the limited amount of herbicide that would be applied to the ground under this alternative compared to the area contributing to runoff.

Research suggests that ground-based herbicide applications following label requirements are not likely to impair surface waters. A study conducted in the SCNF (Rose 2002) concluded that herbicide applications similar to those proposed under this alternative did not impact surface water quality. After application of 1 pound per acre of picloram on study plots adjacent to streams in Texas grasslands, Haas et al. (1971) measured concentrations of picloram of 0.029 mg/L after the first rainfall event. This is substantially less than the 0.5 mg/L maximum contaminant level set by the EPA for drinking water. In this study, picloram was undetectable in

surface waters after subsequent rainfall events. In a study of the environmental fate of picloram used for roadside invasive plant control in Montana, Watson et al. (1989) detected no concentrations of picloram in adjacent streams and suggested that after application to a small portion of the watershed (1%), increased streamflow volume following storms would dilute any picloram mobilized to streams to low levels.

Leaching

Leaching of herbicides through the soil can potentially result in contamination of surface water or groundwater. Movement of a pesticide can be described in terms of the relationship between the sorption coefficient and the half-life (Vogue et al. 1994). Herbicides with a low sorption coefficient and a long half-life, such as chlorsulfuron, dicamba, metsulfuron-methyl, and picloram (Table 3-24) have the greatest ability to leach through soils and reach groundwater or surface water.

Once in the soil, the persistence of many herbicides in soil can be relatively short, as they can break down quickly as discussed in the "Herbicide Properties" section above. Herbicide persistence in soil depends on a number of factors including microbial decomposition, hydrolysis, photodegradation, and volatilization. A variety of organisms can contribute to decomposition, including bacteria, actinomycetes, and fungi. Herbicide decomposition occurs most quickly in conditions that favor these organisms, such as warm, moist, and nutrient-rich soils (National Council for Air and Stream Improvement, Inc. 2009). In the proposed project area, herbicide decomposition likely varies with soil composition, landtype, aspect, and elevation. Arid slopes with thin soils would favor photodegradation over microbial decomposition. Riparian valley bottom soils would be more favorable to microbial decomposition.

Of the herbicides considered under this alternative, picloram has the highest potential for leaching into soil and contamination of groundwater and surface water because of its high leachability, long persistence, and high solubility. It is broken down by ultraviolet light, and degradation by microorganisms is slow. Watson et al. (1989) conducted studies of picloram soil mobility and persistence at two sites in western Montana after ground-based herbicide invasive plant treatments. At the first site, they measured rapid photo decay related to high sunlight and low precipitation, and no herbicide was detected below a depth of 20 inches. At the second site, with 4 times the concentration of herbicide (1 pound/acre) applied adjacent to a stream on sandier soils with abundant shade, they measured half the rate of photo decay, and herbicide was detected to a depth of 40 inches. The second site represents a scenario of application of picloram over a shallow water table. In both of these cases, herbicide was not detected in groundwater or surface water, indicating that minimal leaching occurred.

Other herbicides with low sorption coefficients and moderate leachability such as 2,4-D have a much lower potential for leaching through soils. Radosevich and Winterlin (1977) studied the persistence of 2,4-D and 2,4,5-T in soil after ground-based application in chaparral vegetation in California. They found that although 50% of the recovered herbicide was found on the soil surface litter, only 0.1 to 0.2% of the recovered herbicide was found in the soil, and no herbicide was found below 5 cm soil depth. In this study, herbicide residues decreased rapidly within 30 days following treatment.

Under the Current Action alternative, herbicide applications would be unlikely to enter either surface water or groundwater by way of leaching through soils. Spot treatments would result in minimal contact of herbicide with soils, while some contact would occur through ground-based broadcast applications. Research suggests that with the exception of herbicides applied over shallow water tables, leaching is an unlikely mechanism for herbicides to enter water because of limited chemical mobility and relatively short persistence (Norris et al. 1983). Under the Current Action alternative, ground-based application of herbicides over shallow aquifers would be minimal. Shallow aquifers are limited within the project area to narrow bands below riparian areas along primarily narrow valley floors, and no ground-based broadcast application would occur within 50 feet of streams or ponded water bodies. Terms and conditions under the NMFS BO also specify that application of picloram, clopyralid, chlorsulfuron, and metsulfuron-methyl should be avoided within annual floodplains where the water table is within 6 feet of the surface and soil permeability is high (USDC NMFS 2012).

Herbicide Modeling

Forest Service herbicide risk assessments for herbicides considered under the Current Action (SERA 2004a, 2004b, 2004c, 2004d, 2004e, 2004f, 2006, 2011a, 2011c, 2011d) provide results of GLEAMS and Gleams-Driver modeling for herbicide application adjacent to streams (Table 3-25) and ponds (Table 3-26). In each risk assessment, concentrations of herbicides in water are modeled following application of herbicide in a square treatment area that drains directly into a stream and a square treatment area that drains directly into a pond. Table 3-25 and Table 3-26 show the GLEAMS or Gleams-Driver input parameters and the results, expressed as maximum concentration of herbicide in water. The risk assessments modeled herbicide delivery for a variety of soil types and a variety of climates, representing conditions nationwide. Clay, loam, and sandy soils all exist within the project area. Results for the range of climates found within the project area are summarized, representing a generic arid lowland site (average annual precipitation of 5 inches for Gleams-Driver modeling and 10 inches for GLEAMS modeling) and a generic cooler, moister upland site (average annual precipitation of 33 inches for Gleams-Driver modeling and 25 inches for GLEAMS modeling.

Table 3-25: Summary of GLEAMS and Gleams-Driver modeling results from US Forest Service herbicide risk assessments for herbicide application adjacent to a stream, for herbicides considered in the Current Action Alternative

GLEAMS: Modeled maximum concentrations of herbicide in a stream. Units in µg/L per lb./acre applied.						
	Average annual precipitation: 10 inches			Average annual precipitation: 25 inches		
	Clay	Loam	Sand	Clay	Loam	Sand
2,4-D[2]	0	0	0	236	0	0.00000997
Chlorsulfuron[1]	0	0	0	42.45427	0	1.56313
Clopyralid[1]	0	0	0	8.50807	0.42790	2.65217
Dicamba[1]	0	0	0	0.12122	0.00004	0.00820
Imazapic[1]	0	0	0	0.15831	0	0.02283
Metsulfuron-methyl[1]	0	0	0	0.46168	0.00992	0.08221
Sulfometuron-methyl[1]	0	0	0	0.27655	0	0.02907

[1] GLEAMS model assumes herbicide treatment of a 10-acre square field with a 60-inch root zone and 4 soil layers that drains directly into a 2 meter wide, 1 foot deep stream that flows at a rate of 4,420,000L/day and a velocity of 0.08m/sec. Additional input parameters provided in SERA (2004a, 2004b, 2004c, 2004d, 2004e, 2004f).
[2] GLEAMS model assumes herbicide treatment of a 10-hectare field with a 60-inch root zone, draining directly into a 2-meter wide stream that flows at a rate of 710,000L/day and a velocity of 0.08m/sec. Additional input parameters provided in SERA (2006).

Gleams-Driver: Modeled maximum peak concentrations of herbicide in a stream (median value of 100 simulations). Units are in µg/L per lb./acre applied.						
	Dry/Temperate Location[1]			Average Rainfall/Cool Location[2]		
	Clay	Loam	Sand	Clay	Loam	Sand
Picloram[3]	0.7	0	0	2.49	1	19
Glyphosate[4]	0.00016	0	0	6.3	0.08	0
Triclopyr[3,5]	0.004	0	0	0.4	0	0

[1] Standard Gleams-Driver site based on climate of Bishop, CA (average annual rainfall 5.34 inches, average annual temperature 56.02 degrees F).
[2] Standard Gleams-Driver site based on climate of Sault Ste. Marie, MI (average annual rainfall 32.94 inches, average annual temperature 40.07 degrees F).
[3] Gleams-Driver model assumes herbicide treatment of 10-acre square field with a 36-inch root zone that drains directly into a 2-meter wide stream that flows at a rate of 710,000L/day and a velocity of 6900m/day. Additional input parameters provided in SERA (2011c, 2011d).
[4] Gleams-Driver model assumes herbicide treatment of 10-acre square field with a 60-inch root zone that drains directly into a 2-meter wide stream that flows at a rate of 710,000L/day and a velocity of 6900m/day. Additional input parameters provided in SERA (2011a).
[5] Following application of Triclopyr TEA.

Table 3-26: Summary of GLEAMS and Gleams-Driver modeling results from US Forest Service herbicide risk assessments for herbicide applicaton adjacent to a pond, for herbicides considered in the Current Action Alternative.

GLEAMS: Modeled maximum concentrations of herbicide in a pond. Units in µg/L per lb./acre applied.						
	Average annual precipitation: 10 inches			Average annual precipitation: 25 inches		
	Clay	Loam	Sand	Clay	Loam	Sand
2,4-D[2]	0	0	0	17.8	0	0.00000237
Chlorsulfuron[1]	0	0	0	36.77989	0	4.33955
Clopyralid[1]	0	0	0	4.94710	1.15098	6.41084
Dicamba[1]	0	0	0	0.06974	0.00002	0.00964
Imazapic[1]	0	0	0	0.14009	0	0.00970
Metsulfuron-methyl[1]	0	0	0	0.40388	0.03358	0.46725
Sulfometuron-methyl[1]	0	0	0	0.21133	0	0.04038

[1] GLEAMS model assumes herbicide treatment of a 10-acre square field with a 60-inch root zone and 4 soil layers that drains directly into a 1-acre pond with a depth of 2 meters and a 0.01 sediment fraction. Additional input parameters provided in SERA (2004a, 2004b, 2004c, 2004d, 2004e, 2004f).
[2] GLEAMS model assumes herbicide treatment of a 10-hectare field with a 60-inch root zone, draining directly into a 1-hectare pond with a depth of 2 meters and a 0.01 sediment fraction. Additional input parameters provided in SERA (2006).

Gleams-Driver: Modeled maximum peak concentrations of herbicide in a pond (median value of 100 simulations). Units are in µg/L per lb./acre applied.						
	Dry/Temperate Location[1]			Average Rainfall/Cool Location[2]		
	Clay	Loam	Sand	Clay	Loam	Sand
Picloram[3]	0.24	0	0	0.9	0.5	13.5
Glyphosate[4]	0.00006	0	0	3.5	0.03	0
Triclopyr[3,5]	0.0013	0	0	0.13	0	0

[1] Standard Gleams-Driver site based on climate of Bishop, CA (average annual rainfall 5.34 inches, Average annual temperature 56.02 degrees F).
[2] Standard Gleams-Driver site based on climate of Sault Ste. Marie, MI (average annual rainfall 32.94 inches, Average annual temperature 40.07 degrees F).
[3] Gleams-Driver model assumes herbicide treatment of 10-acre square field with a 36-inch root zone that drains directly into a 1-acre pond with a depth of 2 meters and a sediment depth of 2cm. Additional input parameters are provided in SERA (2011c, 2011d).

[4] Gleams-Driver model assumes herbicide treatment of 10-acre square field with a 60-inch root zone that drains directly into a 1-acre pond with a depth of 2 meters and a sediment depth of 2cm. Additional input parameters are provided in SERA (2011a).
[5] Following application of Triclopyr TEA.

Results of GLEAMS and Gleams-Driver modeling suggest that no herbicides would be delivered to streams or ponds in arid locations (average annual precipitation of 5 to 10 inches). In locations with higher annual precipitation (25 to 33 inches), herbicides could potentially be delivered to surface waters. Aside from precipitation, soil type is the largest factor influencing herbicide delivery. Runoff is the primary delivery mechanism in clay soils, while percolation is the primary mechanism in sandy soils. GLEAMS modeling suggests that in general, runoff is associated with higher concentration of herbicide in streams and ponds than percolation.

The results presented in Table 3-25 and Table 3-26 are generic herbicide concentrations per lb./acre herbicide applied. These results can be applied to scenarios within the project area, although with some limitations. For example, under the Current Action alternative, application of 0.75 lb./acre of picloram across a 10-acre field adjacent to a stream with similar characteristics as the input parameters in the GLEAMS modeling would likely result in no concentrations of herbicides in water when applied on loam or sand soils in arid regions such as along the Salmon River Breaks near North Fork. This same herbicide application scenario applied in a wetter climate within the project area could potentially result in concentrations in an adjacent stream of 0.75µg/L for application on loamy soils and 14.25µg/L for application on sandy soils. These concentrations are a very small fraction of the 0.5mg/L drinking water standard established by the Environmental Protection Agency for picloram.

GLEAMS and Gleams-Driver modeling assumes direct drainage into the water body, but in reality, established buffer zones would likely capture some portion of the herbicide delivered from the treated unit. Under the Current Action alternative, no broadcast spraying would occur within 50 feet of a water body, substantially reducing the potential for herbicide to reach surface water through runoff or percolation. Also, because treatment areas under this alternative would likely be small and isolated (i.e. it is unlikely that an entire 10-acre plot would be treated using ground-based methods), any impacts would be less severe than those shown in the modeling. However, this modeling also assumes that the precipitation is evenly distributed in a uniform amount each day for the first year of simulations (SERA 2007b). It is possible that this modeling underestimates herbicide delivery from storms, as herbicide delivery from high intensity summer thunderstorms would possibly be better modeled using a higher average annual precipitation value.

Adjuvants

Adjuvants are solution additives mixed with herbicide solution to improve performance of a spray mixture. Adjuvants can increase the effectiveness of an herbicide, sometimes by as much as 5 or 10 times, as well as the selectivity of an herbicide (Tu et al. 2001). These factors could result in less herbicide being required for a specific application, potentially decreasing the effects that an herbicide might have on water quality. Adjuvants can also decrease the potential for herbicide to wash off plant leaves after application, reducing the amount of herbicide that could potentially leach into soil or be mobilized by overland flow.

However, the potential also exists for adjuvants to mobilize and enter water bodies. Risk assessments have not been completed for the adjuvants proposed in this project. The toxicities

of herbicides when combined with adjuvants are not generally known, and the environmental fate of many adjuvants is not always known or disclosed. However, the adjuvants proposed in this project are not listed as toxic compounds when used as intended and label direction is followed (USDC NMFS 2012). The use of 50-foot buffers (and 15-foot buffers for MSO) for adjuvants established under the Current Action alternative would minimize adverse effects on water quality. Label direction would always be followed, providing additional assurance that the proper adjuvant would be combined with the correct herbicide at appropriate mixing rates.

Accidental Spills of Herbicide

As discussed above, the potential for normal herbicide application under the Current Action alternative to adversely affect water quality is minimal. Accidental spills of herbicide occurring at staging areas or treatment areas also have the potential to impact water quality under the Current Action alternative. These concerns are addressed through numerous design criteria, BMPs, and label direction requiring spill prevention plans, cleanup kits, equipment inspections, secure transport of only the amount of herbicide needed, stipulations to mix and load herbicides at least 100 feet from water, and the requirement that herbicides are applied by or under the direct supervision of a licensed applicator. With typically small areas being treated, the amount of herbicide involved in a spill under the Current Action alternative would likely be low. Because spills that would potentially impact water quality are highly unlikely, a worst case scenario of an herbicide spill into water was not analyzed for this alternative.

Public Sources of Drinking Water

Herbicide control could potentially occur within the source protection areas established by the Idaho Department of Environmental Quality (refer to Water Uses section, above). Invasive plants are currently limited in these areas, and the percentage of each source protection watershed that would potentially be treated would be small. For example, the Jesse Creek/Chipps Creek/Pollard Creek Watershed, supplying most of the drinking water for the city of Salmon, currently has only 44.7 acres of infestations (0.4% of the watershed). Any treatments in these areas would likely be limited to ground-based spot treatments with minimal herbicide output. Furthermore, because most of this area is undeveloped and will likely remain so, vectors such as roads and trails that could accelerate the spread of invasive plants are not present, and large scale infestations that would require extensive herbicide control are less likely to occur than in more developed areas.

Mitigation measures under the NFMS BO require that no herbicides are applied within a 100-foot radius of any potable water spring development. Additional mitigation measures, BMPs, and Label direction limit the application of herbicides near water and in riparian areas. Based on the analysis above and considering that only ground-based herbicide application would occur under this alternative, the effects of herbicide application on water quality would be minimal and would not likely result in exceedances of the EPA water quality standards for drinking water.

Indirect effects

The treatment methods proposed under the Current Action alternative would have no indirect effects on herbicide concentrations in water.

Effects on Riparian Function

Direct Effects

The Current Action alternative would have minimal direct effects on riparian function. Biological control methods would have no adverse effects on riparian function, because treatment would be target-specific, and no off-target impacts to riparian vegetation would occur. Similarly, herbicide control methods would have minimal adverse effects because only target-specific ground-based spot applications would occur within 50 feet of streams and ponded water bodies, with no likely effects to non-target species. Ground-based broadcast application in RHCAs outside of this 50-foot buffer could result in some off-target impacts to native riparian vegetation, depending on the herbicide used. A small amount of short term localized disturbance to existing riparian vegetation would occur as a result of mechanical methods and rehabilitation/restoration methods that take place within riparian areas. These short term adverse effects would be overshadowed by long term beneficial effects, with the overall result being a decrease in invasive plant infestations at treated sites. Impacts to riparian function would be minimal because in many cases where treatments would occur, and particularly in the case of rehabilitation/restoration treatments, riparian function may already be compromised by invasive plant infestations.

Indirect Effects

The Current Action alternative would have a number of indirect adverse effects on riparian function related to the spread of invasive plants in RHCAs. Because this alternative limits treatment methods within riparian areas to biological control, ground-based spot herbicide application, ground-based broadcast application at locations greater than 50 feet from water, manual/mechanical control, and rehabilitation/restoration, and also limits annual herbicide control within 100 feet of water to 550 acres, it is unlikely that these treatments would keep up with the spread of invasive plants in riparian areas or result in a reduction in total invasive plant infestations within RHCAs. The total acres of infestations within RHCAs is likely to increase slightly over the next 10 to 15 years under the Current Action alternative, but at a lesser rate than under the No Action alternative.

Potential indirect effects related to the continued spread of invasive plants in riparian areas under the Current Action alternative would include decreased bank stability, increased bank erosion, and changes to channel morphology related to the decreased rooting strength of invasive plants compared to native woody shrubs in the long term. These impacts would be similar to those described under the No Action alternative, but the rate of change would be slower and the magnitude of change would be less. Because existing large invasive plant infestations within RHCAs would continue to spread, the riparian ecosystem within and around these infestations would likely continue to decline in structure and productivity. However, current management strategies would allow for effective treatment of some small, localized infestations in riparian areas.

Effects on Soil Condition

Direct Effects

The Current Action alternative would have limited direct effects on soil condition caused by ground disturbance and the effects of herbicides on soil microbes.

Herbicide Concentrations in Soils: GLEAMS and Gleams-Driver simulations in the Forest Service herbicide risk assessments (SERA 2004a, 2004b, 2004c, 2004d, 2004e, 2004f, 2006, 2011a, 2011c, 2011d) were also used to model concentrations of herbicides in soil and maximum penetration into the soil column (Table 3-27). For all herbicides, the highest modeled concentrations occurred in clay soils, and the lowest concentrations occurred in sandy soils. This is related to losses associated with percolation, with sandy soils having higher infiltration rates and higher herbicide mobility. Modeling indicates that herbicide concentrations in the top 12 inches of soil often decrease with increasing precipitation because of losses related to percolation. However, this is not always the case, as it is dependent on herbicide properties. Differing rates of precipitation do not make as much of a difference in herbicide concentrations in soils as in streams and ponds. However, differing rates of precipitation make a large difference on the depth of soil penetration of herbicide, with deeper penetration occurring in wetter climates. For herbicides that were modeled using Gleams-Driver at 1 pound per acre, herbicide penetration occurred up to a depth of 36 inches in an average rainfall/cool climate, and 18 inches in a dry/temperate climate. The arid conditions within most of the project area would inhibit deep penetration of herbicide into soils.

Soil Erosion: Direct effects of the Current Action alternative on soil erosion would include minor short term disturbances from manual/mechanical and rehabilitation/restoration treatments as discussed in Instream Sediment Loads. These localized, short term effects would have minimal impacts on overall soil condition, with the desired long term result being improvement of soil condition as native species are reestablished. Furthermore, many of these treatments (particularly rehabilitation/ restoration) would be occurring in locations where soil condition is already degraded because of existing large scale invasive plant infestations. Any potential short term impacts would occur to a very small percentage of soils on a watershed scale because of the limited extent of treatments that would occur under this alternative.

Soil Microbes: Some of the herbicides proposed for use under the Current Action alternative could have short term adverse impacts to microbial communities within soils (Table 3-24). Picloram, sulfometuron-methyl, and triclopyr have been shown to have some level of toxicity to microorganisms, even at low application rates (Weidenhamer and Callaway 2010; SERA 2011c, 2004f, 2011d). All other herbicides proposed for use under the Current Action alternative have low or short term toxicity to soil microbes. In areas heavily infested with invasive plants, microbial communities and mycorrhizal associations may already be adversely affected by secondary compounds released by certain invasive plants (Alford et al. 2009; Weidenhamer and Callaway 2010).

Eradication of invasive plant infestations and reestablishment of native vegetation would allow for the recovery of soil microbes in the long term. Trevors (1998) suggested that most effects to soil microbes occur when herbicides are applied at higher than recommended concentrations. A review of research also indicates that the effects of herbicides on soil microbes are highly variable and dependent on numerous environmental conditions. Furthermore, any potential short term impacts would occur to a very small percentage of soils on a watershed scale because of the limited extent of treatments that would occur under this alternative.

Table 3-27: Summary of GLEAMS and Gleams-Driver modeling results from US Forest Service herbicide risk assessments for herbicide applicaton in soils, for herbicides considered in the Current Action Alternative

GLEAMS: Maximum modeled concentrations of herbicide in soil. Units in mg herbicide/kg soil (or ppm) modeled at a rate of 1 lb. a.e./acre.						
	Average annual precipitation: 10 inches			Average annual precipitation: 25 inches		
	Clay	Loam	Sand	Clay	Loam	Sand
2,4-D[2]	0.174	0.161	0.161	0.166	0.161	0.159
Chlorsulfuron[1]	0.33	0.27	0.25	0.32	0.25	0.21
Clopyralid[1]	0.27	0.26	0.22	0.23	0.21	0.19
Dicamba[1]	3.99	3.53	3.53	3.99	3.53	3.53
Imazapic[1]	5.73	4.83	3.56	4.90	3.53	3.53
Metsulfuron-methyl[1]	4.86	3.98	3.60	3.99	3.53	3.53
Sulfometuron-methyl[1]	4.97	4.18	3.56	4.00	3.53	3.53

[1] GLEAMS model assumes herbicide treatment of a 10-acre square field with a 60-inch root zone and 4 soil layers. Additional input parameters provided in SERA (2004a, 2004b, 2004c, 2004d, 2004e, 2004f).
[2] GLEAMS model assumes herbicide treatment of a 10-hectare field with a 60-inch root zone. Additional input parameters provided in SERA (2006).

Gleams-Driver: Maximum modeled herbicide concentrations in the top 12 inches of soil. Units are in mg herbicide/kg soil (or ppm) modeled at a rate of 1 lb. a.e./acre.						
	Dry/Temperate Location[1]			Average Rainfall/Cool Location[2]		
	Clay	Loam	Sand	Clay	Loam	Sand
Picloram[3]	0.276	0.263	0.251	0.293	0.25	0.23
Glyphosate[4]	0.38	0.176	0.176	0.277	0.176	0.176
Triclopyr[3,5]	0.229	0.215	0.215	0.237	0.222	0.222

Gleams-Driver: Modeled herbicide maximum depth of soil penetration. Units are in mg herbicide/kg soil (or ppm) modeled at a rate of 1 lb. a.e./acre.						
	Dry/Temperate Location[1]			Average Rainfall/Cool Location[2]		
	Clay	Loam	Sand	Clay	Loam	Sand
Picloram[3]	18	18	18	36	36	36
Glyphosate[4]	4	4	4	8	8	8
Triclopyr[3,5]	12	12	12	18	18	24

[1] Standard Gleams-Driver site based on climate of Bishop, CA (average annual rainfall 5.34 inches, Average annual temperature 56.02 degrees F).
[2] Standard Gleams-Driver site based on climate of Sault Ste. Marie, MI (average annual rainfall 32.94 inches, Average annual temperature 40.07 degrees F).
[3] Gleams-Driver model assumes herbicide treatment of 10-acre square field with a 36-inch root zone. Additional input parameters provided in SERA (2011c, 2011d).
[4] Gleams-Driver model assumes herbicide treatment of 10-acre square field with a 36-inch root zone. Additional input parameters provided in SERA (2011a).
[5] Following application of Triclopyr TEA.

Indirect Effects

The Current Action alternative would have a number of indirect long term effects on soil erosion, organic material, soil mechanics, soil nutrients and chemistry, and soil microbes related to the presence of invasive species. These effects would occur as a result of the expected continued spread of existing invasive plant infestations. The effects would be similar to those described under the No Action alternative, but the magnitude of these effects and the rate of

change would be less severe because the rate of spread of invasive plant infestations would be lower.

Cumulative Effects

Cumulative Effects of Invasive Plant Treatments

Under the Current Action alternative, biological, mechanical, and ground-based herbicide control of invasive plant infestations would continue to occur. The direct and indirect effects of these treatments would include localized areas of ground disturbance and low risk of herbicides entering bodies of water. Any adverse effects that would occur would likely be short term and would be followed by long term beneficial effects related to the control of invasive plant infestations and reestablishment of native vegetation in those areas.

The Current Action alternative would result in minimal cumulative effects related to the direct and indirect effects of treating invasive plants using biological, mechanical, herbicide, and rehabilitation/restoration control methods.

Biological Control Methods

Biological control methods would have no cumulative effects on water and soil condition because no ground disturbance would occur.

Herbicide Control

Ground-based herbicide control would have minimal cumulative effects on water quality, also because of the highly localized nature of the disturbance and the very small percentage of the project area that would be treated annually (0.2%). Other potential sources of water quality impairment within the analysis area include county herbicide application and application of herbicide on private lands. Herbicide application applied by Cooperative Weed Management Associations (CWMAs) by county, as well as herbicides applied by the Bureau of Land Management (BLM) and herbicides applied by the Forest Service within the Salmon-Challis National Forest portion of the Frank Church River of No Return Wilderness are referenced in Appendix H. These numbers do not include herbicide applied by private land owners. Because these treatments have little overlap with the treatments proposed in this project, label application rates per acre would not be exceeded, and the cumulative effects on water quality would be minimal. Although herbicide use rates on private lands are unknown, the application of herbicide on Forest Service lands is likely to be considerably less than that on private agricultural lands because of differing treatment objectives.

The indirect effects on sediment loads related to plant mortality and decreased groundcover following herbicide treatment would be localized, and any adverse impacts would be short term. These indirect effects would cause minimal cumulative effects. For example, herbicide treatment would result in minimal cumulative effects if a wildfire were to occur in the same area following treatment, because an extensive amount of bare ground would be exposed naturally as a result of the fire. In this case, the invasive plant treatment could potentially provide the beneficial effect of promoting native groundcover reestablishment following the fire.

Mechanical and Rehabilitation/Restoration Control Methods

Mechanical and rehabilitation/restoration control methods would have minimal cumulative effects in addition to other activities occurring in the area because of the highly localized nature of the disturbance and the very small percentage of the project area that would be treated. This short term disturbance would not exacerbate the effects of other activities in the project area, and would ultimately provide a long term benefit.

Cumulative Effects of Invasive Plant Infestations

Because methods under the Current Action alternative are not sufficient to cause an overall decline in invasive plant infestations on a watershed scale, the indirect effects of this alternative include gradually increasing sediment yield and sediment loads as a result of the gradual spread of invasive plant and decreased groundcover. Cumulative effects related to these indirect effects combined with other ongoing and foreseeable future activities could occur in the long term, as discussed in Cumulative Effects of Invasive plant Treatments for the No Action alternative, but to a lesser degree because of the expected slower rate of spread.

A matrix was developed to assess the risk of cumulative effects for the Current Action alternative based on the factors considered in the Watershed Condition Framework (Table 3-28). It is expected that continuation of existing invasive plant treatments would slow the spread of invasive plants such that watersheds currently with less than 5% infested acres would have minimal cumulative effects. However, because of the expected continued spread of invasive plant infestations, the risk of cumulative effects would be higher for class 2 watersheds with over 5% infested acres and class 1 watersheds with over 10% infested acres.

Table 3-28: Long term cumulative effects risk matrix for sixth-level watersheds for the Current Action Alternative

		Percent of Watershed infested by Invasive Plants				
		<1%	1-5%	5-10%	10-25%	>25%
Watershed Condition Class	1	L	L	L	M	H
	2	L	L	M	H	H
	3	L	M	H	H	H

L=low, M=moderate, H=High

Under the Current Action alternative, long term effects of the gradual spread of invasive plants would likely result in cumulative effects in some 6th-level watersheds based on this analysis. As invasive plants continue to spread as predicted under the Current Action alternative, cumulative effects would gradually increase, leading to additional watershed impairment. However, these effects would be less severe than under the No Action alternative because the rate of spread of invasive plants is expected to be less, and existing invasive plant control would target high priority areas where cumulative effects are more likely to occur.

Under the Current Action alternative, one watershed has a high risk for cumulative effects, and four watersheds have a moderate risk (Appendix N). These watersheds are located in the 'North' invasive plant management zone, where infestations are most concentrated. Because the spread of invasive plant affects many of the attributes in the Watershed Condition Framework, it is possible that these cumulative effects could result in degradation of watershed condition class for watersheds with Moderate or High cumulative effects risk ratings in the long term (greater than 10 years).

Summary of Effects – Current Action Alternative

The Current Action alternative would potentially result in minimal short term and slight long term increases in instream sediment loads, a gradual long term decline in riparian function, and slight short term impairment and gradual long term decline in soil condition. The effects of this alternative on herbicide concentrations in water would be minimal. This alternative would result in a high risk of cumulative effects in one watershed and a moderate risk in four watersheds.

The Current Action alternative would be compatible with Forest Plans and other regulatory direction with respect to soil and water resources.

3.3.6.3. Alternative 3-Proposed Action

Direct and Indirect Effects

General Effects

Under the Proposed Action, existing invasive plant infestations are expected to gradually decline as existing invasive plant infestations are treated and the spread of new infestations into susceptible areas is prevented through an EDRR approach. The Proposed Action would utilize a variety of methods to halt the spread of invasive plants and reintroduce native vegetation to existing infested areas. It is expected that vegetative cover would improve in the long term over existing conditions, resulting in beneficial effects to soil and water resources.

Treatment of invasive plants under the Proposed Action would have minimal direct adverse effects on soil and water resources. With a maximum of 20,000 acres treated annually, or 0.6% of the 3.1 million acre project area, any impacts would likely be minimal on a watershed scale. Design criteria (Appendix J), BMPs (Appendix O), and label direction would minimize the potential for herbicides to adversely affect soil and water resources. Potential effects are discussed in the following sections.

As opposed to the Current Action alternative, the Proposed Action would be able to effectively and efficiently treat a large number of acres using aerial herbicide control. This would avoid the ground-disturbing effects that could occur if ground-based mechanical and herbicide treatments were used to treat these same acres. However, aerial application of herbicide also increases the potential for non-target application of herbicide and the potential for herbicide to be mobilized into surface water or groundwater. These potential effects are discussed in the following sections.

Aquatic herbicide control is also a component of the Proposed Action that is not proposed in the Current Action alternative. Potential effects of aquatic herbicide control on water quality include short term direct adverse effects, short term indirect adverse effects, and long term beneficial effects. These effects are discussed in the following sections.

Indirect effects of the Proposed Action would include potential short term adverse effects and long term beneficial effects to soil and water resources. A reduction in the size of existing invasive plant infestations would over time lead to improved vegetative cover, decreased sediment yields, improved soil condition, and improved riparian function. These effects are also discussed in the following sections.

Effects on Instream Sediment Loads

Direct Effects

Under the Proposed Action, direct adverse effects on sediment yield caused by the implementation of invasive plant treatments would be minimal and would likely have no measurable effect on basin sediment yields. Potential sources of erosion are the same as those discussed under the Current Action alternative related to ground disturbance caused by the treatments themselves. Although the Current Action does not specify the maximum number of acres to be treated under the various methods (with the exception of a maximum number of acres applied with herbicide), the Proposed Action would result in considerably more acres treated annually than have occurred annually over the last three years under current management.

Biological control methods would have no direct effects on sediment loads, because ground-disturbing activities would not occur under this method.

Ground disturbance as a result of on-road and off-road access to transport and spray herbicides would be minimal. Compared to the Current Action alternative, this activity would cover more acres, but design criteria and BMPs would minimize any site-specific impacts. Repetitive off-road travel is not likely to occur over the same route, limiting the amount of soil disturbance and potential erosion that could occur. Design criteria restrict off-road travel if damage to soils could occur due to wet conditions, and require that no visible “trail” creation occurs. Furthermore, the use of aerial application would allow treatment of large areas using herbicide with no ground disturbance.

Manual and mechanical treatments would occur on up to 2,000 acres. Compared to the Current Action alternative, this activity would cover more acres than the annual average over the last 3 years, but design criteria and BMPs would help to minimize any disturbance. Short term ground disturbance would occur where manual control methods such as hand pulling occurs, but because this method can only be effectively used for small infestations, any impacts would be highly localized. It is not likely that soil or bare ground exposed by these isolated impacts would result in measurable increases in stream channel sediment loads, and the long term effects of reestablishing native plants would be beneficial to water quality.

The most extensive direct ground disturbance would occur during rehabilitation and restoration activities. However, design criteria limiting treated slopes to less than 45% and landtype erosion hazard ratings to low or moderate would prevent large scale erosion from occurring during and after these treatments. Also, because soils in these areas would likely be already experiencing increased erosion as a result of invasive plant infestations, additional ground disturbance would likely have minimal additional effects on erosion or water quality, and the long term effects would be beneficial. These effects would be the same as under the Current Action alternative.

Indirect Effects

Herbicide treatments could result in increased soil exposure and erosion potential in the short term as a result of vegetation mortality and decreased groundcover, particularly in monoculture stands of invasive plants or if non-target species are widely affected by herbicide treatments. This would be most likely to occur with broad-spectrum herbicides during ground-based or aerial broadcast applications. However, design criteria, BMPs, and appropriate selection of

herbicide would limit these effects by ensuring that methods minimize to the extent possible the application of herbicide to non-target species. These potential effects are likely to occur in the short term (less than 1 year), prior to reestablishment of native vegetation.

Any short term increases in sediment delivery caused by vegetation mortality after herbicide treatment would likely be overshadowed by the long term indirect beneficial effects occurring as a result of reestablishment of native vegetation. The proposed biological, herbicide, manual/mechanical, and rehabilitation/restoration methods would result in increased groundcover and improved root structure that would stabilize soils and protect soils from erosive forces such as wind, rain drop impact, and runoff. This would result in decreased sediment delivery to streams in the long term.

Although the indirect effects of existing invasive plant infestations may currently include increased sediment loads, increased turbidities, channel aggradation, and decreased channel stability, these effects would gradually diminish over time under this alternative as infestations are controlled.

Hillslope Scenario

Under the Proposed Action, the greatest potential for water quality impairment related to sediment would be from decreased groundcover and increased soil exposure related to aerial herbicide application. The potential magnitude of these effects was analyzed for an example treatment scenario (Table 3-29) using the Disturbed WEPP model (Elliot and Hall 2010) to predict the probability of erosion and sediment delivery.

Table 3-29: Input parameters and results of Disturbed WEPP modeling of erosion before and after aerial herbicide treatment of a knapweed-infested hillslope near North Fork, Idaho

Aerial treatment of knapweed (50-year simulation) on 60% slope with sandy loam soils		Pre-treatment	Post-treatment	2 years after treatment
Upper Slope	Gradient (top/mid)	60% / 60%	60% / 60%	60%/60%
	Horizontal Length	900 ft.	900ft	900ft
	Vegetation Condition/Treatment	“Skid Trail”	“Skid Trail”	“Good Grass”
	Percent Cover	25%	10%	50%
	Percent Rock	20%	20%	20%
Lower Slope	Gradient (top/mid)	30% / 30%	30% / 30%	30% /30%
	Horizontal Length	100 ft.	100ft	100ft
	Vegetation/Treatment	“Skid Trail”	“Skid Trail”	“Good Grass”
	Percent Cover	25%	10%	50%
	Percent Rock	20%	20%	20%
Results	Probability of erosion	16%	18%	2%
	Erosion rate (tons/acre): 10-yr Return Period	0.51	1.19	0.00
	Probability of sediment delivery	18%	22%	4%
	Sediment delivery (tons/acre): 10-yr Return Period	0.51	1.19	0.00

Under this scenario, a 1000-foot long hillslope is aerially treated with herbicide near North Fork, Idaho, on a 60% slope of sandy loam soils that is heavily infested with a monoculture stand of

knapweed. The toe of the slope (lower 100 feet of slope) has a 30% gradient. Pre-treatment vegetation conditions include approximately 25% groundcover by knapweed with degraded soil conditions. The Disturbed WEPP "skid trail" condition represents these conditions with respect to groundcover and soil condition. Treatment results in 90% mortality of knapweed, causing a nearly immediate reduction in groundcover from 25% to 10%. These conditions persist for a short period of time, but groundcover improves over the following two growing seasons to 50% as native bunchgrasses are reestablished. This improved condition is adequately represented by the "good grass" condition in Disturbed WEPP.

Sediment delivery under this scenario modeled using Disturbed WEPP indicate an increase in the probability of erosion and sediment delivery as a result of vegetation mortality immediately after treatment (i.e., the short term indirect adverse effects described above). However, potential rates of erosion decrease to near zero after reestablishment of native bunchgrass vegetation (i.e. the long term indirect beneficial effects described above).

Effects on Herbicide Concentrations in Water

Under the Proposed Action, up to 16,000 acres could be treated annually using herbicides, with ground and aerial applications. Aquatic applications could also be used to treat an unspecified number of acres using an EDRR approach. Depending on the proportion of these acres that would occur as aerial application versus ground application, as much as twice the maximum herbicide application could occur as compared to the Current Action alternative and approximately 10 times the annual amount applied over the last 3 years. Three additional herbicides not considered in the Current Action alternative would also be available for specified uses under the Proposed Action. These include aminopyralid, imazamox, and imazapyr.

Direct Effects

The effects of ground application of herbicides and mechanisms of herbicides to enter water are discussed under the Current Action alternative. The following discussion highlights additional effects that would occur under the Proposed Action as a result of 1) additional application methods (aerial and aquatic), 2) additional herbicides to be used, and 3) additional acres that would be treated.

As in the Current Action alternative, herbicide applications under the Proposed Action have the potential to affect levels of herbicide in water, depending on a number of factors. However, adherence to design criteria, BMPs, and Label direction would minimize the potential for any adverse impacts to water quality from herbicide application.

Biological control, manual/mechanical methods, and rehabilitation/restoration methods would have no effects on concentrations of herbicides in water.

Herbicide Properties

Forest Service risk assessments have been completed by Syracuse Environmental Research Associates, Inc. (SERA) for all herbicides proposed under this alternative (SERA 2004a, 2004b, 2004c, 2004d, 2004e, 2004f, 2006, 2007a, 2010, 2011a, 2011b, 2011c, 2011d). These include three additional herbicides that were not discussed under the Current Action alternative. Information from these risk assessments for these herbicides regarding herbicide behavior in soil and water is referenced in Table 3-30 and summarized below.

Aminopyralid: Aminopyralid is a relatively new herbicide that is registered provisionally as a reduced risk herbicide for control of broadleaf invasive plants. This herbicide may provide similar results as other herbicides, but with reduced risk to some non-target species.

Aminopyralid is soluble in water and highly mobile, with moderate persistence in soil. Therefore, it has the potential to leach into groundwater. Breakdown occurs through photolysis.

Imazamox: Imazamox is an herbicide used for control of numerous terrestrial and aquatic invasive plants. This herbicide is very soluble in water and adheres poorly with soil. Therefore, it has a high potential to be mobilized during runoff, posing some risk to non-target plants. Mobility in soil is moderate to high. Degradation occurs primarily through microbial activity in soil.

Imazapyr: Imazapyr is a non-selective herbicide used to control many types of invasive plants. This herbicide is very soluble in water and can be mobilized by runoff. However, imazapyr also binds strongly with organic particles in the soil and can also be mobilized in runoff along with eroded soil particles. This herbicide is persistent in soil, and breakdown in soil occurs slowly by microbial activity. Persistence in water is short, and breakdown in water occurs primarily by photolysis.

Herbicide Pathways to Water

The potential for herbicides to enter water under each of the mechanisms described in Norris et al. (1983) was presented for the Current Action alternative. Additional discussion of these mechanisms under the context of the Proposed Action is presented below.

Direct Applications

*Ground Applicatio*ns: Similar to the Current Action alternative, the potential for direct application of herbicide to water under the Proposed Action would be minimal for ground applications. Design criteria require that no broadcast application would occur within defined riparian areas (this is more restrictive than the Current Action alternative in many situations), and ground based spot applications are highly unlikely to result in direct application to water. See Appendix E for herbicide application guidelines near water.

Aerial Applications: Because aerial application would require a 300-foot buffer on all live water (perennial streams, flowing intermittent streams, lakes, ponds, springs, and wetlands), the potential for direct application to water would be minimal. The potential for drift of herbicide to reach water is further discussed in the Drift section below.

Table 3-30: Herbicide behavior in soil and water, for all herbicides proposed under the Proposed Action

Herbicide (Active Ingredient)	Proposed Use [1]	Half Life in Water (days) [2]	Water Solubility (mg/L) [2]	Half Life in soil (days) [2]	Sorption Coefficient (soil K_{oc}) [2]	Pesticide Movement Rating (Leachability)	Toxicity to soil microbes [2]	Degradation mechanism(s)
2,4-D amine	U,R	45	569	6.2	61.7	Moderate	Short Term	Soil microbes
Aminopyralid	U,R,Ae	1000	205,000	343	0.87 - 8.91	High (?)	Low	Photolysis
Chlorsulfuron	U,R, Ae	200	27,900	37 - 168	40	High	Low	Soil microbes
Clopyralid	U,R, Ae	261	1,000	14-29	0.4 - 12.9	Mod-High	Low	Soil microbes
Dicamba	U	39	6,500	31	2.4 - 32.5	High	Low (?)	Soil microbes
Glyphosate	U,R,Aq	21	12,000	5.4	2,000 - 24,000	Low	Low	Soil microbes
Imazamox	R,Aq	365	4,413	81	2 - 374	Mod-High (?)	Unknown	Soil microbes
Imazapic	U, Ae	30	36,000	113	112	Low	Unknown	Soil microbes
Imazapyr	U,R,Aq	19.9 - 199	11,100	313 - 2972	8 - 110	Low (?)	Low	Photolysis Soil microbes
Metsulfuron-methyl	U,R,Ae	1213	2,790	120	35	High	Short Term	Soil microbes Water
Picloram	U,Ae	2.6-15	200,000	18 - 513	2.2 - 92.9	Mod-High	High	UV light Soil microbes
Sulfometuron methyl	U,R,Ae	113	300	10 - 100	78	Mod-High	Indirect> Direct	UV light Soil microbes
Triclopyr (TEA)	U,R,Aq	426	440	8 - 28.4	25 - 134	Mod-High	Short Term	Soil microbes

[1] Proposed uses: U=upland, R=Riparian, Aq=Aquatic, Ae=Aerial
[2] Data from US Forest Service herbicide risk assessments (SERA 2004a, 2004b, 2004c, 2004d, 2004e, 2004f, 2006, 2011a, 2011c, 2011d). Values represent typical values or range used as parameters for GLEAMS modeling.

Aquatic Applications: Direct application to water would occur by design for aquatic herbicide treatments. Four herbicides would be available for use under this method. Although label direction dictates the maximum application rates for the volume of water being treated, proposed typical application rates would generally be less than the maximum (Table 2-10). The Idaho Rapid Response Strategy from the Idaho Aquatic Nuisance Species Plan (Idaho Invasive Species Council Technical Committee 2007) would be followed for all aquatic applications, providing site specific analysis that takes into consideration the dimensions of the water body, water chemistry, and other factors in order to minimize the potential effects and provide coordination with State and other agencies. Under these specifications, impairment of water quality as a result of herbicide concentrations would be unlikely to occur. The largest water quality concern likely to occur with aquatic herbicide treatments is the potential effects of oxygen depletion from decaying plant matter following treatment. Following the Rapid Response Strategy and label direction would minimize these effects as well. Also, because large quantities of herbicide would be transported and applied over water, the potential exists for a spill directly into water. This unlikely scenario is mitigated by a variety of design criteria and is further discussed in the Accidental Spills of Herbicide section below.

Drift

Ground Applications: The potential for drift of herbicide to enter water bodies for ground applications under the Proposed Action would be minimal, the same as under the Current Action alternative. Design criteria restricting application during windy conditions, BMPs, label requirements for buffers, and the lack of broadcast application within riparian areas would minimize this possibility.

Aquatic Applications: Aquatic applications of herbicide would have no risk of drift occurring because herbicides would be applied directly to the water.

Aerial Applications: The greatest potential for drift to occur under the Proposed Action is during aerial applications. However, drift from aerial applications is unlikely to enter surface water, primarily because of the 300-foot buffer widths on all live water. The primary factors influencing drift are wind direction, wind speed, presence of inversion, droplet size, and interception by vegetation. Design criteria and Label direction would restrict aerial application to conditions with wind speeds of 5 mph or less. Under these conditions, it is very unlikely that drift would reach surface water. In the unlikely event that drift does occur into the 300-foot buffer, monitoring using spray cards within 300 feet of perennial streams would detect the herbicide, allowing applicators to modify practices and prevent any additional impacts (see Appendix G). Design criteria would also require ground checking, flagging, and marking using GPS prior to spraying, as well as GPS technology within the aircraft to ensure that only area marked for treatment are treated.

A number of studies have been conducted to monitor the amount of drift that has occurred during aerial applications through drift card monitoring as well as water quality monitoring. Gluns (1989) detected no concentrations of glyphosate in surface water draining a harvest unit in British Columbia treated with aerial application of 1.78kg/ha of glyphosate, with 100 meter no-spray buffers on water courses. In a study measuring drift of clopyralid during aerial treatments of starthistle in a California grassland, clopyralid was undetectable in surface water following application of 6 ounces per acre of clopyralid with a 30 meter buffer on stream courses and a slight (5 mph) breeze toward the sampled aquatic sites (DiTomaso et al. 2004). This study suggested that

drift potential is minimal, and that 30 meter buffers are adequate for protection of adjacent streams.

The Oregon Department of Forestry studied the potential effects of drift to water quality on 26 stream sample sites adjacent to aerial application of herbicides to forests in Western Oregon (Dent and Robben, 2000). This included applications of glyphosate, chlorothalonil, 2,4-D ester, triclopyr, clopyralid, hexazinone, and sulfometuron, using prescribed buffers under the forest practice rules (60-foot and 300-foot buffers, depending on stream type). Post-spray results showed no detectable concentrations of herbicides at or above 1 ppb. For the 7 samples tested at a minimum detection limit of less than 1 ppb, concentrations of hexazinone and 2,4-D ester in water ranged from 0.1 to 0.9 ppb. This study concluded that the buffers prescribed under the forest practice rules effectively protect water quality during aerial herbicide applications.

The Forest Service has conducted aerial herbicide applications in nearby Forests in Montana. The Lolo National Forest conducted monitoring of aerial applications of picloram on the Mormon Ridge winter range in 1997 and 1999, in a steep area of rolling topography upslope of and adjacent to Mormon Creek. No picloram was detected in water samples following application to a detection level of 0.1 ppb. The study also indicated through drift card monitoring that no drift reached Mormon Creek (USDA Wallowa-Whitman NF 2010). Similar results were obtained during monitoring of aerial herbicide applications on the Bitterroot National Forest in 2004 and 2005 (USDA Wallowa-Whitman 2010). In this study, no herbicides were detected in surface water or on drift cards placed within the 300-foot buffers.

Abundant research has been conducted on off-target deposition of pesticides used for aerially applied agricultural applications. Riley and Wiesner (1989) concluded that a 100 meter buffer zone "would ensure at least a 10-fold decrease" compared to at the edge of the treatment area, even when winds exceed the maximum recommended wind speed. Bird et al. (1996) showed pesticide deposition at 30 meters downwind of treatment to be 5% of the rate within the treatment area. This value was 0.5% at 150 meters downwind.

Bird et al. (1996) suggested that droplet size is the variable that has the largest effect on off-target drift, even more so than wind speed. They suggested that the use of a coarse spray (volume median diameter of 500µm) could result in a 10-fold decrease in off-target drift as compared to a fine spray (volume median diameter of less than 200µm).

Past studies show that the potential exists for herbicide drift to occur beyond the 300-foot buffers specified in the Proposed Action. However, the amount of herbicide reaching these areas is likely to be very low, and as shown in numerous studies discussed above, they are not likely to result in detectable concentrations of herbicide in surface water. Design criteria for the Proposed Action requiring the use of larger droplet size to the extent possible, no application when sustained wind speeds exceed 5 mph, and no application during periods of inversions would minimize the potential for adverse effects to water quality related to drift.

Mobilization in Ephemeral Streams and Channels

Ground Applications: The potential for herbicide to enter water bodies through mobilization in ephemeral channels would be minimal for ground applications under the Proposed Action, the same as under the Current Action alternative.

Aquatic Applications: Aquatic applications of herbicide would have no risk of mobilization in ephemeral channels because herbicides would not be applied to ephemeral channels.

Aerial Applications: Aerial application of herbicide would not occur within riparian zones or within 300 feet of any live water. However, aerial application could occur on ephemeral or intermittent stream channels that do not have flowing water at the time and do not have defined riparian vegetation. In this situation, herbicide could potentially be mobilized during the first runoff event following application, depending on the persistence and other properties of the herbicide. This is further discussed in the Overland Flow section below.

Overland Flow

Ground Applications: The potential for herbicide to enter water bodies through mobilization by overland flow under the Proposed Action would be the same as under the Current Action alternative for ground applications. Applications under the Proposed Action are likely to cover more acres, but they would occur as scattered, targeted treatments of small infestations and would have minimal effects on water quality on a watershed scale.

Aquatic Applications: Aquatic applications of herbicide would have no risk of mobilization by overland flow because herbicides would be applied directly to water bodies.

Aerial Applications: Aerial herbicide applications are capable of covering large areas with a uniform cover of herbicide. This is the most likely mechanism for herbicides to reach surface water under the Proposed Action. Rainfall can mobilize herbicide applied to plants or soil, depending on the herbicide properties.

A number of studies have measured concentrations of herbicides in streams adjacent to aerial herbicide treatment units. The Oregon Department of Forestry measured herbicide concentrations following aerial herbicide applications in Western Oregon using buffers prescribed under the forest practice rules (60 feet or 300 feet, depending on stream type). In this study, herbicide concentrations were not detected in any of the 7 samples from 3 sites after the first runoff event following the aerial application (Dent and Robbens 2000). McBroom et al. (2013) conducted herbicide runoff studies in paired watersheds in Texas after aerial and ground application of herbicides. They found that herbicides were only detected in streams during storm events, and the peak concentrations were short-lived. In this study, approximately 1 to 2% of applied imazapyr and less than 1% of applied hexazinone and sulfometuron were measured in the storm runoff. Aerial broadcast application resulted in higher concentrations in runoff than ground-based banded applications. However, it was also determined that the timing and magnitude of runoff is the largest factor influencing herbicide dispersal.

Because of the variety of processes influencing overland flow discussed above, the mobility of herbicide after aerial treatment would vary greatly with the herbicide being used, the location, and environmental factors. Therefore, it is not possible to disclose the effects of every possible treatment within the 3.1 million acre project area. With respect to the Proposed Action, the delivery of herbicides to surface water via overland flow is dependent on a number of chemical and environmental factors. The effects of these factors on the delivery of herbicides to surface water are discussed below. Prior to any aerial application of herbicide in the Proposed Action, design criteria require that the Aerial Herbicide Application Coordination and Safety Implementation Plan (Appendix F) is followed. This coordination would include site specific analysis of the factors

discussed below, in order to determine appropriate treatments that would minimize adverse effects.

Rate of herbicide application and area treated: Following label recommendations and design criteria would minimize the potential for mobilization of abundant herbicide during runoff.

Runoff characteristics: The timing and magnitude of runoff may be the largest factor influencing delivery of herbicides to surface water via overland flow (McBroom et al. 2013). Because some herbicides degrade quickly, very little may be left by the time the first rainstorm occurs. Within the project area, rainstorms can be rare during mid-summer, but frequent occurrences during late summer.

Soil infiltration capacity: Soil properties influence how runoff is generated. Soils with low infiltration capacity will have the highest potential for runoff, and therefore the highest potential to result in the transport of herbicides to water bodies. Infiltration capacities of the types of soil within the project area are discussed in the Landtype and Soils section.

Herbicide properties: Herbicide properties including soil half-life, sorption coefficient, solubility, and the amount of time until an herbicide is "weatherfast" on leaves and soil influence the amount of herbicide that would be mobilized by overland flow (Table 3-30). Herbicides such as aminopyralid, imazamox, chlorsulfuron, clopyralid, dicamba, metsulfuron-methyl, and picloram that have low sorption coefficients and high solubility are most susceptible to transport by overland flow. Herbicide degradation occurs through microbial activity, water, and/or ultraviolet light, depending on the chemical. Herbicides such as 2,4-D and Glyphosate degrade relatively quickly by microbial activity and are not likely to be mobilized during runoff unless a storm occurs immediately following application.

Amount of plant uptake of herbicide: By nature, aerial herbicide application is not target-specific. In areas where invasive plants create dense groundcover, herbicide uptake is likely to be higher than in areas with sparse groundcover. Where uptake by plants is low, more herbicide would be residing on the soil surface and could potentially be mobilized by overland flow.

Proximity of application to surface water: A longer flow path to a water body would result in greater potential for herbicide degradation, adsorption to soil particles and organic matter, and dilution prior to entering the water body.

Streamflow characteristics: Low streamflow would result in higher concentrations of herbicide, whereas high streamflow would cause rapid dilution. A high ratio of treated area to contributing watershed drainage area would result in higher risk of water quality impacts. For example, a 100-acre treatment in a small upland watershed draining 2 square miles would have a much higher risk to water quality than the same treatment along the Salmon River, which drains 5,500 square miles.

Leaching

Ground Applications: The potential for of herbicide to enter water bodies through leaching as a result of ground application would be unlikely under the Proposed Action, the same as under the Current Action alternative. Applications would likely cover more acres, but they would occur as scattered, targeted treatments of small infestations and would have minimal effects on a watershed scale.

Aquatic Applications: Aquatic applications of herbicide would have no risk of leaching because herbicides would be applied directly to water bodies.

Aerial Applications: The processes in which herbicides degrade in soil under the Proposed Action would be the same as discussed for the Current Action alternative. However, the potential for herbicides to contaminate groundwater or surface water by way of leaching through soil would be greater than under the Current Action alternative because aerial application would result in more direct contact of herbicides with soil.

Under the Proposed Action, the potential to contaminate groundwater by leaching of herbicides through soils is low. As discussed in the Current Action alternative, leaching is generally not a prominent mechanism for herbicide mobility because many herbicides are quickly degraded in soil by microorganisms, but the highest potential for groundwater contamination occurs when herbicide is applied over a shallow water table. Neary and Michael (1996) suggest that forest herbicide use poses little risk to groundwater because the rate, frequency, and extent of application are minimal on a watershed scale. In the Proposed Action, shallow water tables are limited in the project area to narrow strips along valley floors, and the 300-foot buffers established on all live water would virtually eliminate any treatments over shallow water tables. The presence of shallow water tables would also be an avoidance factor for consideration in the Aerial Herbicide Application Coordination and Safety Implementation Plan (Appendix F).

Herbicide Modeling

Modeling of herbicide delivery to a stream and a pond were conducted in the Forest Service herbicide risk assessments (SERA 2004a, 2004b, 2004c, 2004d, 2004e, 2004f, 2006, 2007a, 2010, 2011a, 2011b, 2011c, 2011d). Results of modeling for the ten herbicides used in the Current Action alternative are presented in Table 3-25: Summary of GLEAMS and Gleams-Driver modeling results from US Forest Service herbicide risk assessments for herbicide application adjacent to a stream, for herbicides considered in the Current Action Alternative and Table 3-26. Results of modeling for the three additional herbicides that would also be used in the Proposed Action are presented in Table 3-31 and Table 3-32.

Table 3-31: Summary of Gleams-Driver modeling results from US Forest Service herbicide risk assessments for herbicide application adjacent to a stream, for additional herbicides considered in the Proposed Action

Gleams-Driver: Modeled maximum peak concentrations of herbicide in a stream (median value of 100 simulations). Units are in µg/L per lb/acre applied.						
	Dry/Temperate Location[1]			Average Rainfall/Cool Location[2]		
	Clay	Loam	Sand	Clay	Loam	Sand
Aminopyralid[3]	0.087	0	0	30	33	100
Imazamox[3]	3.7	0	0	25.4	1.51	0.0027
Imazapyr[4]	2.14	0	0	5.2	0.31	5.3

[1] Standard Gleams-Driver site based on climate of Bishop, CA (average annual rainfall 5.34 inches, average annual temperature 56.02 degrees F).
[2] Standard Gleams-Driver site based on climate of Sault Ste. Marie, MI (average annual rainfall 32.94 inches, average annual temperature 40.07 degrees F).
[3] Gleams-Driver model assumes herbicide treatment of 10-acre square field with a 60-inch root zone that drains directly into a 2-meter wide stream that flows at a rate of 710,000L/day and a velocity of 6900m/day. Additional input parameters provided in SERA (2007a; 2010).

[4] Gleams-Driver model assumes herbicide treatment of 10-acre square field with a 36-inch root zone that drains directly into a 2-meter wide stream that flows at a rate of 710,000L/day and a velocity of 6900m/day. Additional input parameters provided in SERA (2011b).

Table 3-32: Summary of Gleams-Driver modeling results from US Forest Service herbicide risk assessments for herbicide applicaton adjacent to a pond, for additional herbicides considered in the Proposed Action.

Gleams-Driver: Modeled maximum peak concentrations of herbicide in a pond (median value of 100 simulations). Units are in µg/L per lb/acre applied.						
	Dry/Temperate Location[1]			Average Rainfall/Cool Location[2]		
	Clay	Loam	Sand	Clay	Loam	Sand
Aminopyralid[3]	0.03	0	0	100	110	300
Imazamox[3]	1.63	0	0	24.2	1.16	0.005
Imazapyr[4]	0.8	0	0	2.12	0.29	9.4

[1] Standard Gleams-Driver site based on climate of Bishop, CA (average annual rainfall 5.34 inches, Average annual temperature 56.02 degrees F).
[2] Standard Gleams-Driver site based on climate of Sault Ste. Marie, MI (average annual rainfall 32.94 inches, Average annual temperature 40.07 degrees F).
[3] Gleams-Driver model assumes herbicide treatment of 10-acre square field with a 60-inch root zone that drains directly into a 1-acre pond with a depth of 2 meters and a sediment depth of 2cm. Additional input parameters provided in SERA (2007a; 2010).
[4] Gleams-Driver model assumes herbicide treatment of 10-acre square field with a 36-inch root zone that drains directly into a 1-acre pond with a depth of 2 meters and a sediment depth of 2cm. Additional input parameters provided in SERA (2011b).

Applications of this modeling to the project area are discussed in the Current Action alternative. Additional potential effects to water quality related to the three additional herbicides considered in the Proposed Action would be minimal. In arid climates, herbicide delivery to water bodies would be minimal. The highest delivery of herbicide to water bodies would occur in clay soils or sandy soils, depending on the herbicide. Unlike most other herbicides, concentrations of aminopyralid and imazapyr would be highest after application on sandy soils because of high leachability and long persistence. No water quality standards exist for the three additional herbicides considered in the Proposed Action. As previously discussed, actual concentrations of herbicide reaching water would likely be lower than suggested by modeling because no broadcast application would occur in riparian areas, and buffers would capture a portion of the herbicide.

Adjuvants

The effects of the use of adjuvants on water quality would be minimal, similar to the Current Action alternative. The proper use of adjuvants would likely result in an increase in efficiency in aerial herbicide applications and potentially a decrease in adverse effects.

Public Sources of Drinking Water

Similar to the Current Action alternative, the potential effects of the Proposed Action on herbicide concentrations on public sources of drinking water would be minimal. No aerial herbicide application would occur within the Idaho Department of Environmental Quality source protection areas. This includes municipal supply watersheds for Salmon and Challis, as well as 1000-foot radius areas surrounding a number of public wells. No aquatic herbicide application would occur within source protection areas.

Accidental Spills of Herbicide

Although highly unlikely, the accidental spill of herbicide into or near a water body during herbicide application or staging could potentially affect water quality, depending on the amount spilled and the characteristics of the water body. The risk of accidental spill of herbicide into water under the Proposed Action is higher than under the Current Action alternative because of the larger quantities of herbicide that would be transported and mixed. However, design criteria under the Proposed Action would minimize these risks by stipulating that mixing and loading of herbicides occur more than 100 feet from water and in places where spilled materials would not flow into groundwater, wetlands, or streams. Procedures in the SCNF spill plan would be followed, and a site-specific emergency response plan would be developed for each aerial application, as specified under the Aerial Herbicide Application Coordination and Safety Implementation Plan (Appendix F). Because these design criteria minimize the potential for the majority of spill scenarios (with the exception of a handful of highly unlikely catastrophic scenarios), spill scenarios are not analyzed in this document.

Effects on Riparian Function

Direct Effects

The Proposed Action would have minimal direct adverse effects on riparian function in the short term. Biological control methods would have no adverse effect on riparian function because treatments would not affect non-target vegetation. Manual/mechanical methods would have minimal effect on non-target vegetation as a result of minor disturbance to existing riparian vegetation during treatments. Rehabilitation/restoration treatments would have minimal effect on existing riparian vegetation because these methods would only be used where invasive plant infestations have already replaced most or all native riparian vegetation. All of these treatments would have beneficial effects to riparian function in the long term by eradicating or reducing invasive plant populations and allowing native riparian vegetation to recover.

Herbicide control methods would have a slight potential to cause non-target mortality of native vegetation within riparian zones. However, these effects would be minimal, primarily because no ground-based broadcast herbicide treatments would occur within riparian areas, and no aerial herbicide application would occur within 300 feet of any water body. The 300-foot buffers would include most riparian areas within the project area. The potential for non-target application of aerial herbicide in riparian areas is highest where treatment units would be adjacent to riparian areas (e.g., where a riparian area extends a full 300 feet from a water body). In this situation, a small percentage of aerially applied herbicide would likely reach a portion of the riparian area through drift. Design criteria, BMPs, and Label direction, including stipulations on wind speed, atmospheric conditions, and droplet size would minimize the amount of drift occurring in riparian areas. The amount of herbicide reaching riparian vegetation would decrease substantially with distance from the treatment area. Bird et al. (1996) showed pesticide deposition at 30 meters and 150 meters downwind of treatment to be 5% and 0.5% of the rate within the treatment area, respectively.

Depending on the herbicide being used, herbicide drift into riparian areas could cause some short term adverse effects to existing native riparian vegetation. However, because of the distance from the treatment area, this would have minimal or no effects to near-stream riparian vegetation, maintaining riparian function in relation to stream channel function and stability. Any short term adverse effects to riparian vegetation would be overshadowed by the long term benefits to riparian

function gained by eradicating or reducing invasive plant infestations and reestablishing native vegetation in its place.

Indirect Effects

Because the Proposed Action would over time decrease the extent of invasive plant infestations within riparian areas, indirect effects of the Proposed Action on riparian function would primarily be beneficial improvements to riparian condition as a result of invasive plant eradication and reestablishment of native riparian vegetation in the long term. This would result in maintained or increased bank stability, channel stability, and shade, as well as a riparian structure capable of maintaining large woody debris inputs to stream channels.

Effects on Soil Condition

Direct Effects

The Proposed Action would have limited direct adverse effects on soil condition caused by ground disturbance and the effects of herbicides on microbial communities within soils.

Herbicide Concentrations in Soils: GLEAMS and Gleams-Driver were used in the Forest Service Herbicide Risk Assessments to model concentrations of herbicides in soil and maximum penetration into the soil column (SERA 2004a, 2004b, 2004c, 2004d, 2004e, 2004f, 2006, 2007a, 2010, 2011a, 2011b, 2011c, 2011d). Generic soil modeling results for the three additional herbicides considered in the Proposed Action are presented in Table 3-33. Modeling of all herbicides considered in the Proposed Action (Table 3-27 and Table 3-33) indicates that herbicide concentrations in the top 12 inches of soil often decrease with increasing precipitation because of losses related to percolation. However, this is not always the case. For all herbicides, the highest modeled herbicide concentrations in soils were in clay soils. Concentrations in loam and sandy soils were lower because of losses associated with percolation. Of the three additional herbicides considered in the Proposed Action, aminopyralid has the highest mobility, with modeling suggesting that leaching can occur to 60 inches or greater in all soil types in average rainfall/cool climates. Aminopyralid is more likely to reach groundwater than all other herbicides considered.

Table 3-33: Summary of Gleams-Driver modeling results from US Forest Service herbicide risk assessments for herbicide application in soils, for additional herbicides considered in the Proposed Action.

Gleams-Driver: Maximum modeled herbicide concentrations in the top 12 inches of soil. Units are in mg herbicide/kg soil (or ppm) modeled at a rate of 1 lb a.e./acre.						
	Dry/Temperate Location[1]			Average Rainfall/Cool Location[2]		
	Clay	Loam	Sand	Clay	Loam	Sand
Imazamox[3]	0.214	0.197	0.196	0.203	0.186	0.184
Imazapyr[4]	0.36	0.33	0.304	0.34	0.297	0.236
Gleams-Driver: Modeled herbicide maximum depth of soil penetration. Units are in mg herbicide/kg soil (or ppm) modeled at a rate of 1 lb a.e./acre.						
	Dry/Temperate Location[1]			Average Rainfall/Cool Location[2]		
	Clay	Loam	Sand	Clay	Loam	Sand
Imazamox[3]	18	18	24	30	36	60
Imazapyr[4]	18	18	18	36	36	36

[1] Standard Gleams-Driver site based on climate of Bishop, CA (average annual rainfall 5.34 inches, Average annual temperature 56.02 degrees F).
[2] Standard Gleams-Driver site based on climate of Sault Ste. Marie, MI (average annual rainfall 32.94 inches, Average annual temperature 40.07 degrees F).
[3] Gleams-Driver model assumes herbicide treatment of 10-acre square field with a 60-inch root zone. Additional input parameters provided in SERA (2010).
[4] Gleams-Driver model assumes herbicide treatment of 10-acre square field with a 36-inch root zone. Additional input parameters provided in SERA (2011b).

GLEAMS: Maximum modeled concentrations of herbicide in top 12 inches of soil column. Units in mg herbicide/kg soil (or ppm) modeled at a rate of 1 lb a.e./acre.						
	Average annual precipitation: 10 inches			Average annual precipitation: 25 inches		
	Clay	Loam	Sand	Clay	Loam	Sand
Aminopyralid[1]	0.525	0.508	0.45	0.268	0.229	0.212
GLEAMS: Modeled herbicide maximum depth of soil penetration. Units are in mg herbicide/kg soil (or ppm) modeled at a rate of 1 lb a.e./acre.						
	Average annual precipitation: 10 inches			Average annual precipitation: 25 inches		
	Clay	Loam	Sand	Clay	Loam	Sand
Aminopyralid[1]	6.5	6.5	6.5	60	60	60

[1] GLEAMS model assumes herbicide treatment of a 10-hectare square field with a 60-inch root zone and 4 soil layers. Additional input parameters provided in SERA (2007a).

Soil Loss: Direct effects of the Proposed Action on soil loss would include minor disturbances from manual/mechanical and rehabilitation/restoration treatments, as well as motorized access for herbicide treatments that could result in localized occurrences of soil loss in the short term during subsequent runoff events. These effects would be greater than under the Current Action alternative because of the larger number of acres that would be treated. Similar to the Current Action alternative, many of these treatments would be occurring in locations where soil productivity is already limited because of existing invasive plant infestations. However, with only 2,000 acres of mechanical treatment planned throughout the 3.1 million acre project area (0.06% of the project area), these effects would have minimal effect on a watershed scale. Biological control methods would have no impact on soil loss.

Soil Microbes: Herbicide treatment methods would be the only mechanism under the Proposed Action that would have direct effects on microbial communities in soil. With the ability to treat nearly twice as many applied acres as the maximum allowed under the Current Action alternative,

the effects of the Proposed Action on soil microbial communities would potentially be greater than that described under the Current Action alternative. Short term effects to soil microbes would likely occur as a result of broadcast and aerial herbicide applications because of the likelihood that a portion of the herbicide would directly reach the soil using these methods. As described in the Current Action alternative, some herbicides have been shown to be toxic to some microorganisms. The additional herbicides proposed under the Proposed Action would each have low or unknown toxicity to soil microbes (Table 3-30). Microbial communities in many treatment areas would likely be already compromised by the effects of the invasive plant infestations themselves. Any short term effects caused by herbicide application would ultimately be overshadowed by the long term beneficial effects of invasive plant eradication and reestablishment of native riparian vegetation, which would allow the recovery of biological communities within the soil.

Indirect Effects

It is expected that invasive plant infestations would decrease in size and extent under the Proposed Action. Therefore, the indirect effects described under the Current Action alternative on soil erosion, organic material, soil mechanics, soil nutrients and chemistry, and soil microbes related to the presence of invasive plants would not occur under the Proposed Action or would occur to a lesser extent. However, the Proposed Action could result in short term increases in soil loss as a result of target and non-target vegetation mortality on slopes after treatment. These effects would be overshadowed by the long term benefits of restoring native vegetation, which would improve soil condition.

Cumulative Effects

Cumulative Effects of Invasive Plant Treatments

Under the Proposed Action, biological, mechanical, herbicide, and restoration/ rehabilitation control of invasive plant infestations would occur. The direct effects of these treatments would include localized areas of ground disturbance and low risk of herbicides entering water bodies. Any adverse effects that would occur would likely be short term, and would be followed by long term beneficial effects related to the control of invasive plant infestations and reestablishment of native vegetation in those areas. Indirect effects related to vegetation mortality following herbicide treatment could occur in the short term, with long term beneficial effects following.

The Proposed Action would result in minimal cumulative effects related to the direct and indirect effects of treating invasive plants using biological, mechanical, herbicide, and rehabilitation/restoration control methods.

Biological control methods

Biological control methods would have no cumulative effects on water and soil condition because no ground disturbance or water impairment would occur.

Herbicide Control

Ground-based, aerial, and aquatic herbicide control would have minimal cumulative effects on water quality. Although herbicide control would be more widespread than under the Current Action alternative, this treatment would still cover only a very small percentage of the project area (0.5%). Other potential sources of water quality impairment within the analysis area include county, BLM,

and other Forest Service herbicide application (Table 3-8 and Table 3-9) and application of herbicide on private lands. Because these treatments have little overlap with Forest Service treatments, label application rates per acre would not be exceeded, and the cumulative effects on water quality would be minimal. Although herbicide use rates on private lands are unknown, the application of herbicide on Forest Service lands is likely to be considerably less than that on private agricultural lands because of differing treatment objectives.

The indirect effects on sediment loads related to plant mortality and decreased groundcover following herbicide treatment would be greater than under the Current Action alternative, but any adverse impacts would be short term. These indirect effects would cause minimal cumulative effects. As an example, bare ground exposure and sediment loss resulting from herbicide application would be minimal compared to the bare ground exposure and sediment loss resulting naturally from a high intensity wildfire in the same watershed. In this case, the invasive plant treatment could potentially provide the beneficial effect of promoting native groundcover reestablishment following the fire.

Mechanical and rehabilitation/restoration control methods

Mechanical and rehabilitation/restoration control methods would have minimal cumulative effects in addition to other activities occurring in the area because of the highly localized nature of the disturbance and the very small percentage of the project area that would be treated (0.06%). This short term disturbance would not exacerbate the effects of other activities in the project area, and would ultimately provide a long term benefit.

Cumulative Effects of Invasvie Plant Infestations

Invasive plant control methods under the Proposed Action would result in a gradual decline in invasive plant infestations in the project area and on a watershed scale. Therefore, the Proposed Action would result in decreasing cumulative effects related to the indirect effects caused by the presence of invasive plants.

A matrix was developed to assess the risk of cumulative effects for the Proposed Action based on the factors considered in the Watershed Condition Framework (Table 3-34). Under the Proposed Action, the gradual decline in invasive plant infestations would generally result in low risk of cumulative effects for sub-watersheds with currently less than 10% infested acres. Invasive plant control would effectively target priority areas where cumulative effects would be most likely to occur, and this risk would be minimized in the long term. Because existing invasive plant infestations are widespread in some sub-watersheds, the risk of cumulative effects related to indirect effects caused by invasive plants would still exist in the short term. In the most heavily infested watersheds, specifically those with currently greater than 10% infested acres, it is possible that effective control would not occur for many years, and cumulative effects could persist in the long term.

Table 3-34: Long term cumulative effects risk matrix for sixth-level watersheds for the Proposed Action.

		Percent of Watershed Infested by Invasive Plants				
		<1%	1-5%	5-10%	10-25%	>25%
Watershed Condition Class	1	L	L	L	L	M
	2	L	L	L	M	H
	3	L	L	M	H	H

(L=low, M=moderate, H=High)

Under the Proposed Action, no watersheds have a high risk for cumulative effects, and only one watershed has a moderate risk (Appendix N). The moderate risk watershed is in the North Zone invasive plant management area, where infestations are the most concentrated.

Summary of Effects – Proposed Action

The Proposed Action could potentially result in minimal short term increases in instream sediment loads and localized short term impairment of soil condition as a result of invasive plant treatments. However, long term effects resulting from control of invasive plant infestations would be beneficial, with gradual long term decreases in instream sediment loads, long term improvement in riparian function, and long term improvement in soil condition. The effects of this alternative on herbicide concentrations in water would be minimal. Under this alternative, no watersheds would have a high risk of cumulative effects, and only one watershed would have a moderate risk.

The Proposed Action would be compatible with Forest Plans and other regulatory direction with respect to soil and water resources.

3.3.6.4. Alternative 4-No Aerial Herbicide Application

Direct and Indirect Effects

General Effects

The No Aerial Herbicide Application alternative would be slightly more effective at treating invasive plant infestations than the Current Action alternative. However, because it would not include the efficiency of treating large infested areas using aerial application as in the Proposed Action, this alternative would likely result in a continued spread of invasive plant infestations in the project area. The long term spread of invasive plant infestations under this alternative would be less severe than under the Current Action alternative because the use of the additional herbicides would increase the effectiveness of ground-based treatments. Herbicide control would continue as ground-based treatments, which are much less cost-effective than aerial treatments. With time and funding concentrated on treating small infestations, new invaders, and more severe infestations along established vectors, funding would not likely be available to treat existing large, more inaccessible infestations as would occur under the Proposed Action. However, this alternative would be better suited than the Current Action alternative to treating new invasive plants that arrive on the Salmon-Challis National Forest, particularly aquatic invasive plants.

Adverse effects of this alternative would be similar to those described under the Current Action alternative, but with some additional potential effects related to the additional herbicides and use of aquatic treatments as discussed in the effects analysis for the Proposed Action.

In order to achieve similar objectives as the Proposed Action, it is likely that considerably more acres of biological, ground-based herbicide, manual/mechanical, and rehabilitation/ restoration treatment would have to occur under this alternative in order to compensate for the inability to utilize aerial herbicide treatments. These ground-based treatments would likely result in more ground disturbance than under the Proposed Action. However, direct and indirect adverse effects to water quality, soils, and riparian vegetation as a result of non-target herbicide application during aerial application would be less than would occur under the Proposed Action.

Effects on Instream Sediment Loads

Direct Effects

As in the Proposed Action, biological control would have no direct effects on instream sediment loads because no ground-disturbing activities would occur. Ground-based herbicide, manual/mechanical, and rehabilitation/restoration treatments could potentially occur on more acres and hence have more ground disturbance under the No Aerial Herbicide Application alternative as compared to the Proposed Action. As a result, a greater potential exists for these treatments to directly cause erosion and increased sediment yield from slopes in the short term. However, these treatments would still have only minimal short term adverse effects on a watershed scale and would not likely cause any detectable increase in sediment loads in streams.

Indirect Effects

Under the No Aerial Herbicide Application alternative, invasive plant infestations would not be controlled as effectively as under the Proposed Action, particularly for large, inaccessible infestations that cannot be effectively treated without aerial herbicide application. As a result, sediment yield caused by decreased ground cover from infested slopes would remain high and potentially increase as these infestations spread. This would result in possible small increases in sediment loads on a watershed scale in the long term. Sediment yields related to infestations would be higher than under the Proposed Action, but lower than under the Current Action alternative.

Because the No Aerial Herbicide Application alternative would not include aerial application, the short term effects of broadcast application on target and non-target plant mortality, decreased ground cover, and increased sediment yield described under the Proposed Action would occur to a much lesser extent. These effects would be similar to those described under the Current Action alternative.

Effects on Herbicide Concentrations in Water

Direct Effects

The potential for herbicide application under the No Aerial Herbicide Application alternative to affect water quality would be minimal. As in the Proposed Action, design criteria, BMPs, and label direction would provide adequate protection to water bodies, minimizing any potential effects. The same number of acres could potentially be treated using herbicides as in the Proposed Action, but because aerial application of herbicides would not occur, it is likely that fewer acres of broadcast treatment would actually occur, reducing the amount of herbicide that could potentially be delivered to the soil or mobilized by overland flow.

Herbicide Pathways to Water

Potential pathways for herbicides to enter water under the No Aerial Herbicide Application alternative would be similar to those described under the Proposed Action. However, because aerial application would not occur, the potential for drift to deliver herbicide to water bodies would be considerably less.

Adjuvants

The potential for the use of adjuvants to result in effects to water quality under the No Aerial Herbicide Application alternative would be minimal, similar to that described under the Current Action alternative.

Accidental Spills of Herbicide

The potential for the accidental spill of herbicide is described under the Proposed Action. However, because large quantities of herbicide would not be used for aerial application as in the Proposed Action, the potential for accidental spill would be less than under the Proposed Action. Because design criteria minimize the potential for the majority of spill scenarios (with the exception of a handful of highly unlikely catastrophic scenarios), spill scenarios are not analyzed in this document.

Public Sources of Drinking Water

The potential for herbicide treatments under the No Aerial Herbicide Application alternative to affect the quality of public drinking water would be very low, similar to the Current Action alternative and the Proposed Action.

Indirect Effects

As in the Proposed Action, the No Aerial Herbicide Application alternative would have no indirect effects on concentrations of herbicides in water.

Effects on Riparian Function

Direct Effects

Under the No Aerial Application alternative, the effects of biological, manual/ mechanical, and rehabilitation/restoration control methods on riparian function would be the same as described under the Proposed Action.

The effects of herbicide control methods on riparian function would be similar to those described under the Proposed Action because no aerial application would occur in riparian areas in either alternative. However, because the No Aerial Herbicide Application alternative would eliminate the possibility of drift from aerial applications entering riparian areas (as could potentially occur under the Proposed Action), the potential effects of this alternative would be less than under the Proposed Action. Also, this alternative would be able to better target invasive plants in riparian areas than under the Current Action alternative because of the use of the additional herbicides for riparian use, resulting in potentially less non-target mortality, less herbicide needed, and less overall impact on riparian areas.

Indirect Effects

The indirect effects of the No Aerial Herbicide Application alternative on riparian function would be the same as described under the Proposed Action.

Effects on Soil Condition

Direct Effects

Under the No Aerial Herbicide Application alternative, the direct effects of biological, manual/mechanical, and rehabilitation/restoration control methods on soil condition would be the same as described under the Proposed Action.

The direct effects of herbicide control methods on soil condition would be less than those described under the Proposed Action because aerial broadcast application would not occur, decreasing the amount of herbicide contact with the soil. Ground-based spot and broadcast treatments would provide more efficient application of herbicide to plants. Additional direct effects to soils could occur as a result of the ground disturbance related to the addition ground-based treatments, but these effects would be minimal on a watershed scale.

Indirect Effects

The indirect effects of biological, manual/mechanical, and rehabilitation/restoration control methods on soil condition would be the same as described under the Proposed Action.

Under the No Aerial Herbicide Application alternative, the gradual spread of invasive plants would result in increased soil loss in the long term as a result of decreased ground cover. However, short term soil loss as a result of mortality following broadcast herbicide treatments would be less than that described in the Proposed Action because aerial application would not occur.

Cumulative Effects

Cumulative Effects of Invasive Plant Treatments

The direct and indirect effects of the No Aerial Herbicide Application alternative would be similar to those described under the Current Action alternative. However, because additional herbicides would be available for use, this alternative would provide more efficient treatment options and potentially less potential for adverse effects. Despite these small differences, the cumulative effects of this alternative would be similar to those described for the Current Action alternative. The No Aerial Herbicide Application alternative would result in minimal cumulative effects related to the direct and indirect effects of treating invasive plants using biological, mechanical, herbicide, and restoration/rehabilitation methods.

Cumulative Effects of Invasive Plant Infestations

Because methods proposed under the No Aerial Herbicide Application alternative are not sufficient to cause an overall decline in invasive plant infestations on a watershed scale, the indirect effects of this alternative include gradually increasing sediment yield and sediment loads as a result of the gradual spread of invasive plants and decreased groundcover. Cumulative effects related to these indirect effects combined with other ongoing and foreseeable future activities could occur in the

long term. These cumulative effects would be similar to those discussed in the No Action alternative, but would occur to a lesser degree because of the expected slower rate of spread.

A matrix was developed to assess the risk of cumulative effects for the No Aerial Herbicide Application alternative based on the factors considered in the Watershed Condition Framework (Table 3-35). The cumulative effects risk ratings in the matrix are the same as under the Current Action alternative.

Under the No Aerial Herbicide Application alternative, long term effects of the gradual spread of invasive plants would likely result in cumulative effects in some 6th-level watersheds based on this analysis. As invasive plants continue to spread as predicted under this alternative, cumulative effects would gradually increase, leading to additional watershed impairment. However, these effects would be less severe than under the No Action alternative because the rate of spread of invasive plants expected to be less, and existing invasive plant control would target high priority areas where cumulative effects would be most likely to occur.

Table 3-35: Long term cumulative effects risk matrix for sixth-level watersheds for the No Aerial Herbicide Application Alternative.

		Percent of Watershed Infested by Invasive Plants				
		<1%	1-5%	5-10%	10-25%	>25%
Watershed Condition Class	1	L	L	L	M	H
	2	L	L	M	H	H
	3	L	M	H	H	H

(L=low, M=moderate, H=High)

Under the No Aerial Herbicide Application alternative, one watershed has a high risk for cumulative effects, and four watersheds have a moderate risk (Appendix N). These watersheds are in the North invasive plant management zone, where infestations are the most concentrated. Because the spread of invasive plants affects many of the attributes in the Watershed Condition Framework, it is possible that these cumulative effects could result in degradation of watershed condition class for watersheds with Moderate or High cumulative effects risk ratings in the long term (greater than 10 years).

Summary of Effects – No Aerial Herbicide Application alternative

The No Aerial Herbicide Application alternative could potentially result in minimal short term increases in instream sediment loads and localized short term impairment of soil condition as a result of invasive plant treatments. Long term effects resulting from control of invasive plant infestations could include possible slight long term increases in instream sediment loads, long term improvement in riparian function, and gradual long term decline in soil condition. The effects of this alternative on herbicide concentrations in water would be minimal. This alternative would result in a high risk of cumulative effects in one watershed and a moderate risk in four watersheds.

The No Aerial Herbicide Application alternative would be compatible with Forest Plans and other regulatory direction with respect to soil and water resources.

3.3.6.5. Alternative 5-No Aquatic Herbicide Application

Direct and Indirect Effects

General Effects

Because the No Aquatic Herbicide Application alternative is similar to the Proposed Action in every aspect except for the lack of aquatic herbicide applications, the effects of this alternative on soil and water resources would be very similar to those of the Proposed Action (3.3.6.3. Alternative 3-Proposed Action). The primary difference in direct effects would be a decreased potential for water quality impairment as a result of aquatic herbicide applications.

Additional indirect effects could occur under this alternative because the invasive plant management program would not be equipped to manage new aquatic invasive plant infestations on the Salmon-Challis National Forest. Aquatic invasive plants such as Eurasian watermilfoil do not currently exist within the project area, but do exist in the region. If aquatic infestations are introduced into lakes and are not controlled effectively, they could result in major impacts as described in the effects analysis under the No Action alternative. Under the worst case scenario, this could have drastic effects on water chemistry, nutrient loading, water temperature, and habitat.

Effects on Instream Sediment Loads

Under the No Aquatic Herbicide Application alternative, the direct and indirect effects to erosion and sediment loads caused directly by invasive plant treatments and indirectly by infestations would be the same as under the Proposed Action for all treatment methods.

Effects on Herbicide Concentrations in Water

Under the No Aquatic Herbicide Application alternative, the direct effects to herbicide concentrations in water caused by chemical invasive plant treatments would be the same as under the Proposed Action for ground-based and aerial treatment methods. As in the Proposed Action, no indirect effects would occur. Because no herbicide would be applied directly to water, this alternative would have no risk of water quality impairment by this mechanism, as compared to the minimal risk shown under the Proposed Action. The effects on public sources of drinking water would be minimal, the same as under the Proposed Action.

Effects on Riparian Function

Under the No Aquatic Herbicide Application alternative, the direct and indirect effects to riparian function caused directly by invasive plant treatments and indirectly by infestations would be the same as under the Proposed Action for all treatment methods.

Effects of Soil Condition

Under the No Aquatic Herbicide Application alternative, the direct and indirect effects to soil condition caused directly by invasive plant treatments and indirectly by infestations would be the same as under the Proposed Action for all treatment methods.

Cumulative Effects

Cumulative Effects of Invasive Plant Treaments

The direct and indirect effects of the No Aquatic Herbicide Application alternative would be similar to those described under the Proposed Action, but without the effects related to aquatic herbicide applications. Therefore, the cumulative effects of the No Aquatic Herbicide Application alternative would be similar to those of the Proposed Action. The No Aquatic Herbicide Application alternative would result in minimal cumulative effects related to the direct and indirect effects of treating invasive plants using biological, mechanical, herbicide, and rehabilitation/ restoration control methods.

Cumulative Effects of Invasive Plant Infestations

Similar to the Proposed Action, invasive plant control methods under the No Aquatic Herbicide Application alternative would result in a gradual decline in infestations in the project area and on a watershed scale. The No Aquatic Herbicide Application alternative would result in decreasing cumulative effects related to the indirect effects caused by the presence of invasive plants.

A matrix was developed to assess the risk of cumulative effects for the No Aquatic Herbicide Application Alternative based on the factors considered in the Watershed Condition Framework (Table 3-36). The cumulative effects risk ratings in the matrix are the same as under the Proposed Action.

Under the No Aquatic Herbicide Application alternative, the gradual decline in infestations would likely result in low risk of cumulative effects at the sub-watershed scale. Invasive plant control would effectively target priority areas where cumulative effects would be most likely to occur, and this risk would be minimized in the long term. Because existing infestations are widespread in some sub-watersheds, the risk of cumulative effects related to indirect effects caused by invasive plants would still exist in the short term. In the most heavily infested watersheds, it is possible that effective control would not occur for many years, and cumulative effects could persist in the long term. If aquatic invasive plants were to spread into the project area, they would likely occur as isolated occurrences, and cumulative effects of these infestations on a watershed scale would be minimal.

Table 3-36: Long term cumulative effects risk matrix for sixth-level watersheds for the No Aquatic Herbicide Application Alternative

		Percent of Watershed Infested by Invasive Plants				
		<1%	1-5%	5-10%	10-25%	>25%
Watershed Condition Class	1	L	L	L	L	M
	2	L	L	L	M	H
	3	L	L	M	H	H

(L=low, M=moderate, H=High)

Under the No Aquatic Herbicide Application alternative, no watersheds have a high risk for cumulative effects, and only one watershed has a moderate risk (Appendix N). The moderate risk watershed is in the North Invasive plants Management Zone, where infestations are the most concentrated.

Summary of Effects – No Aquatic Herbicide Application Alternative

The No Aquatic Herbicide Application alternative could potentially result in minimal short term increases in instream sediment loads and localized short term impairment of soil condition as a result of invasive plant treatments. However, long term effects resulting from control of invasive plant infestations would be beneficial, with gradual long term decreases in instream sediment loads, long term improvement in riparian function, and long term improvement in soil condition. The effects of this alternative on herbicide concentrations in water would be minimal. Under this alternative, no watersheds would have a high risk of cumulative effects, and only one watershed would have a moderate risk.

The No Aquatic Herbicide Application alternative would be compatible with Forest Plans and other regulatory direction with respect to soil and water resources.

3.4. Fisheries

3.4.1. Introduction

This section analyzes the potential effects to fisheries resources and aquatic habitats from implementation of the alternatives, both from the impacts of invasive plants and the impacts of control measures. This includes treatment of invasive plants using herbicides, mechanical methods and biological control agents.

Invasive plants have the potential to affect fisheries resources and aquatic habitat by destabilizing streams, reducing the quality of fish habitat. Infestations adjacent to or within aquatic influence areas can invade, occupy, and dominate riparian areas and indirectly impact aquatic ecosystems and fish habitat. Invasive plants can change vegetative structure and alter future inputs of wood and leaves that provide the foundation of the aquatic ecosystem food webs. Native vegetation growth may change as a result of infestation, and the type and quality of litter fall, and quality of organic matter may decline, which can alter or degrade habitat for aquatic organisms. Streamside invasive plants colonization can lead to reduced streambank stability, changes in channel geometry, increased sedimentation and elevation of seasonal water temperatures.

Invasive plant treatment activities have the potential to affect fish and aquatic resources directly through contact with herbicides entering waterways at concentrations above levels of concern, or indirectly through impacts to primary production or the trophic structure of benthic algae or invertebrate food base communities. Sub-lethal effects can include changes in behaviors or body functions that are not directly lethal to the aquatic species, but could have consequences to reproduction, juvenile to adult survival, or other important components to health and fitness of the species

Design criteria were developed to minimize or eliminate these potential effects of invasive plant control measures on fisheries resources and aquatic habitats and fisheries resources, and are integrated into the effects analysis of the proposed action.

The Salmon-Challis National Forest is required by law, regulation, and policy to address potential impacts of Federally authorized, funded or implemented project activities, including noxious

invasive plant control measures, on fish species of special designations. The effects of invasive plant treatment on the following species will be analyzed:

- Species listed as threatened, endangered, or candidate fish species under the Endangered Species Act
- Salmon-Challis National Forest Management Indicator Species (MIS)
- USDA Forest Service Region 4 sensitive fish species

3.4.2. Measurement Indicators

- Effects of invasive plant treatments on aquatic organisms
- Adequacy of design criteria that apply to water quality and aquatic organisms

3.4.3. Compliance with Forest Plan and Other Relevant Direction

The Salmon National Forest Land and Resource Management Plan (SNFLRMP)(USDA Salmon NF 1988) provides forest management goals, forest-wide direction, and standards and guidelines regarding fisheries resources and aquatic habitat that are relevant to invasive plant treatments:

Forest Management Goals

- Manage classified threatened and endangered species habitat to maintain or enhance their current status.
- Maintain aquatic habitat capability at a level sufficient to meet State water quality and species production goals for both resident and anadromous fish.
- Control noxious weeds as needed to protect the value of other resources and comply with State law.
- Maintain watershed conditions and water quality such that downstream beneficial uses are protected and compliance with State standards is achieved.

General Direction

- Provide National Forest portion of the habitat needed to meet Regional Wildlife and Fish Management objectives.
- Provide habitat diversity through vegetation treatments in conjunction with other resource activities designed to maintain or improve wildlife or fisheries habitat.

Standards and Guidelines

- Contribute to the local and State economics by providing favorable habitat for socially and economically important fish and wildlife species.
- Place emphasis on improving key ecosystems including but not limited to: riparian, aspen, aquatic, snag and old growth.
- Manage and provide habitat for recovery of endangered and threatened species as specified in the Species Management Plan for the Salmon National Forest.

Salmon National Forest LRMP prescription direction makes no recommendations specific to invasive plant management and fisheries resources. General direction in prescription areas 3A-4A, 3A-5A, 3A-5B and 3A-5C is to emphasize management of anadromous fish habitat at various levels of vegetation (timber) management.

The Challis National Forest Land and Resource Management Plan (USDA Challis NF 1987) also provides forest management goals, forest-wide direction, and standards and guidelines regarding fisheries resources and aquatic habitats that is relevant to invasive plant treatments:

Forest Management Goals

- Provide habitat to ensure viability and recovery of Threatened and Endangered and Forest Service sensitive plants and animals.
- Maintain and improve the current productivity level of wildlife and fish habitat.
- Emphasize anadromous fish habitat management on the Challis National Forest.
- Provide quantity and quality of habitat needed to meet projected wildlife and fish population objectives.
- Improve watershed condition on the Forest.

Forestwide Management Direction, Standards and Guidelines

- Emphasize habitat improvement for Threatened and Endangered Species, Forest Service sensitive and economically and socially important species.

Challis National Forest LRMP Management Area direction largely provides general guidance and makes no recommendations specific to invasive plant management other than general direction to maintain or improve aquatic habitat conditions for anadromous and resident fisheries.

Both the Salmon National Forest and the Challis National Forest Land and Resource Management Plans were amended in 1995 to incorporate a range of management strategies designed to maintain and improve habitat conditions for anadromous and resident fisheries resources within the Interior Columbia River Basin, as identified within the Interim Strategies for Managing Anadromous Fish-Producing Watersheds in Eastern Oregon and Washington, Idaho, and portions of California (PACFISH)(USDA/USDI 1995a), and the Interim Strategies for Managing Fish-Producing Watersheds in Eastern Oregon and Washington, Idaho, Western Montana and Portions of Nevada (INFISH) (USDA/USDI 1995b). The strategies incorporated within these amendments are applied to all proposed or new Forest Service authorized projects, which must also comply with requirements of the Endangered Species Act (ESA), the National Environmental Policy Act (NEPA), the National Forest Management Act (NFMA) and other applicable laws. Direction is in the form of riparian management objectives, standards and guidelines, and monitoring requirements.

PACFISH and INFISH direction identifies standards and guidelines related to invasive plant treatment:

- General Riparian Area Management - RA-3 Apply herbicides, pesticides, other toxicants, and other chemicals in a manner that does not retard or prevent attainment of Riparian Management Objectives and avoids adverse effects on listed anadromous (PACFISH) and inland native (INFISH) fish.

In addition to the LRMPs, laws and regulations such as the Endangered Species Act (ESA) of 1973 (as amended), and the National Forest Management Act (NFMA) of 1976 (P.L. 4-588), are considered for the analysis.

For the No Action Alternative, the absence of an active implementation strategy to address and treat invasive plant infestations on SCNF lands is inconsistent with Management Goals, General

Direction and Standards and Guidelines for fisheries resources and aquatic habitats identified in both the Salmon National Forest and Challis National Forest LRMPs. As identified within the Relevant Direction section of this document, both the Salmon National Forest and Challis National Forest LRMPs have been amended by the 1995 PACFISH and INFISH directives. PACFISH/INFISH standards and guidelines related to invasive plant treatments direct applications of herbicides in a manner that does not retard or prevent attainment of Riparian Management Objectives and avoids adverse effects on listed anadromous and inland fish (General Riparian Area Management standard/guideline RA-3). As there would be no active invasive plant treatment activities proposed under Alternative 1, there does not appear to be clear inconsistency of the alternative with identified PACFISH/INFISH direction within the two Forest Plans.

All actions implemented under Alternatives 2, 3, 4, and 5 are consistent with Management Goals, General Direction and Standards and Guidelines for fisheries resources and aquatic habitats identified in both the Salmon National Forest and Challis National Forest LRMPs. As identified within the Relevant Direction section of this document, both the Salmon National Forest and Challis National Forest LRMPs have been amended by the 1995 PACFISH and INFISH directives. PACFISH/INFISH standards and guidelines related to invasive plant treatments direct applications of herbicides in a manner that does not retard or prevent attainment of Riparian Management Objectives and avoids adverse effects on listed anadromous and inland fish (General Riparian Area Management standard/guideline RA-3). Design criteria for herbicide treatments under Alternative 2 are consistent with this directive.

3.4.4. Methodology for Analysis

3.4.4.1. Approach

Analysis of the potential effects of chemical contaminants on fishes and macroinvertebrates uses two different, but complementary, approaches. These two approaches analyze the possible direct and indirect impacts to aquatic resources using: 1) Risk Quotient Analysis (RQA); and 2) Spill/Runoff/Drift/Leaching Scenarios. These approaches have been used in past years to examine impacts to aquatic species on the Salmon-Challis National Forest (USDA Forest Serivce2003d). The RQA approach examines possible direct risks to aquatic resources using each proposed herbicide. This method assigns a risk quotient, or level of concern, to the use of each herbicide. The scenarios examine examples of herbicide monitoring and the potential for chemical contamination from surface runoff, leaching, accidental spills, and wind drift, as these are the most likely modes of chemical transport to the streams given the project's identified design criteria.

3.4.4.2. Risk Assessments

The effects of herbicide use depend on the toxicity the herbicide, the level of environmental exposure to that herbicide, and the duration of that exposure. Incorporating these variables, risk assessments evaluate the potential effects to non-target plants, wildlife, human health, soils, and aquatic organisms from the herbicides considered for use in the SCNF. The Forest Service contracted with Syracuse Environmental Research Associates, Inc. (SERA) to evaluate human health and ecological effects of herbicides using Environmental Protection Agency (EPA) studies and other peer-reviewed articles from the open scientific literature. Information from laboratory and field studies of herbicide toxicity, exposure, and environmental fate was used to estimate the risk of adverse effects of herbicide use, including potential effects to aquatic organisms, water, and soil.

In addition to the analysis of potential hazards from the active ingredients in the herbicides, the SERA Risk Assessments evaluated available scientific studies of potential hazards of other substances associated with herbicide applications, including impurities, metabolites, inert ingredients, and adjuvants. There is usually less toxicity data available for these substances (compared to the herbicide active ingredient) because they are not subject to the extensive testing that is required for the herbicide active ingredients under the Federal Insecticide, Fungicide, and Rodenticide Act.

Components of the Ecological Risk Assessments include:

- Hazard Characterization
- Exposure Assessment
- Dose Response Assessment
- Risk Characterization

Risk assessments consider worst-case scenarios including accidental exposures and application at maximum label rates. These assessments have a degree of uncertainty in interpretation and extrapolation of data. Uncertainty may result from a study design, questions asked, data collection, data interpretation, and extreme variability associated with aggregate effects of natural and synthesized chemicals on organisms, including humans, and with ecological relationships. Numbers used, particularly in ecological realms, are uncertain, and there are limits on our ability to understand or demonstrate causal relationships. Because of data gaps, assessments rely heavily on extrapolation from laboratory animal tests.

Although the risk assessments have limitations, they represent the best science available for analysis of potential effects of pesticide use on aquatic organisms, and can be used to determine (given a particular set of assumptions) whether there is a basis for asserting that a particular adverse effect is plausible.

The risk assessment methodologies and detailed analysis are incorporated into references of conclusions about herbicide toxicology in this document.

Risk Quotient Analysis

Utilizing information in the respective risk assessments, a risk quotient was developed for rainbow trout and daphnia against each herbicide proposed for use. Rainbow trout can be a good representation of potential impacts to salmonids, while daphnia can represent an important food source for freshwater fishes. These aquatic species are commonly used for determining toxicity values. Risk quotients were not developed for adjuvants because of a lack of information. However, potential effects and aquatic toxicity of adjuvants are discussed where data are available.

The risk quotient was calculated from a safety factor that was derived from known toxicity values for each species divided by an “Expected Environmental Concentration” (EEC). The EEC, expressed in parts per million (ppm), was derived from the direct application of the active ingredient to 1-acre, 1-foot-deep pond using the maximum rate specified on the label (Urban and Cook 1986). The EEC is an extreme level that is unlikely to occur during implementation of the Proposed Action and should be viewed as a worst-case situation. The risk quotient and associated level of concern, therefore, provide a reference from which a possible worst-case situation can be viewed. If the risk quotient is greater than 10, the level of concern is categorized as “Low.” If the risk quotient is between 1 and

10, the level of concern is “Moderate.” If the risk quotient is less than 1, the level of concern is “High.”

Table 3-37: Risk Quotient and Level of Concern for Herbicides Proposed for Use in the Salmon-Challis NF

Herbicide (Active Ingredient)	Species Tested	Risk Quotient and Level of Concern	Species Tested	Risk Quotient and Level of Concern
2,4-D amine	Rainbow Trout	15 (Low)	Daphnia	8.3 (Moderate)
Aminopyralid	Rainbow Trout	124 (Low)	Daphnia	123 (Low)
Chlorsulfuron	Rainbow Trout	266 (Low)	Daphnia	395 (Low)
Clopyralid	Rainbow Trout	28 (Low)	Daphnia	63.0 (Low)
Dicamba	Rainbow Trout	1.9 (Moderate)	Daphnia	6.8 (Moderate)
Glyphosate	Rainbow Trout	36 (Low)	Daphnia	33.7 (Low)
Imazamox	Rainbow Trout	27.2 (Low)	Daphnia	27.2 (Low)
Imazapic	Rainbow Trout	72 (Low)	Daphnia	18.1 (Low)
Imazapyr	Rainbow Trout	181.4 (Low) 38.1 (Low)	Daphnia	1114 (Low) 143.3 (Low
Metsulfuron-methyl	Rainbow Trout	136 (Low)	Daphnia	13.0 (Low)
Picloram	Rainbow Trout	2.6 (Moderate)	Daphnia	9.2 (Moderate)
Sulfometuron methyl	Rainbow Trout	40.2 (Low)	Daphnia	95.7 (Low)
Triclopyr: triethylamine salt (TEA)	Rainbow Trout	2.3 (Moderate)	Daphnia	5.4 (Moderate)

Analysis Area

The analysis area for consideration of direct and indirect effects is the non-wilderness portion of the Salmon-Challis National Forest. The analysis area for consideration of cumulative effects encompasses all land ownerships within the Upper Salmon River, Little Lost River and Big Lost River Basins.

3.4.5. Affected Environment

Aquatic Habitat Conditions and Threats

The watersheds within the Salmon-Challis National Forest provide habitat for more than 20 fish species, including game and non-game species, endangered and threatened anadromous species, and threatened and sensitive resident species. These watersheds also support a variety of benthic invertebrates that are typically important fish foods. Noxious weeds have been shown to influence soil erosion and sedimentation (Lacey et al. 1989), which can adversely affect aquatic resources of the SCNF. Forest and land management practices also may affect fish and their habitat. Excessive sedimentation can alter the streambed, affect spawning and rearing areas and success, and raise water temperatures, resulting in adverse effects to aquatic habitat quantity and quality and the well-being of fish and benthic invertebrate communities.

Government agencies as well as private individuals have stocked fish in some streams and high mountain lakes of the SCNF. Interbreeding between stocked fish and resident species affects the productivity and genetic integrity of some (primarily westslope cutthroat trout and bull trout) native fish populations (Quigley and Arbelbide 1997). In addition, stocked fish can adversely affect native fish species by successfully competing for food and space.

Corridors of the Salmon River and its tributary streams are vulnerable to invasive plants invasions. These systems provide important natural habitat conditions for fish and benthic organisms. They support migration, spawning, rearing, and overwintering by different life stages of anadromous species, and they provide year-round habitat for all life stages of resident species. The river corridors are subject to intense use by humans and wildlife. Human activities include diversion of water from the Salmon River watershed for livestock, agriculture, and community water use. Recreational activities like camping, fishing, and whitewater rafting are popular on nearly every stretch of these waters. Mining, timber, and livestock grazing activities can also affect the quality of the habitat.

Generally, instream flows in the SCNF adequately support healthy riparian communities and aquatic habitat. These flows are affected by human use (primarily irrigation) at lower elevations, sedimentation, and drought.

Roads confine many of the rivers and major streams in the SCNF. These roads can contribute to the sedimentation of drainages and provide avenues for the proliferation of invasive plants . Road construction has reduced riparian habitat, thus reducing the recruitment of wood into the stream channels that contribute to the formation of pools and provides cover for aquatic species. Conversion of some riparian areas to other uses further degrades habitat by removing native vegetation and replacing it with non-native grasses and other landscaping, thereby increasing an area’s vulnerability to invasive plants.

Invasive plants control at or near the headwaters of rivers and tributaries in the SCNF can have a direct beneficial downstream effect on riparian habitat and the health of aquatic resources by reducing seed dispersal and the threat of invasive plants establishment. As noted previously (Lacey et al. 1989), invasive plants have been shown to influence soil erosion and sedimentation, adversely affecting aquatic habitat and fish populations.

Federally-Listed Fish Species

Four species of federally-listed fish may occur within the SCNF. The USFWS identifies these species as sockeye salmon, Chinook salmon, steelhead, and bull trout. The federally listed representatives of these four species that may occur in the SCNF are the Snake River sockeye salmon, Snake River spring/summer Chinook salmon, Snake River steelhead, and bull trout. The sockeye salmon is listed as endangered and the other fish species are listed as threatened. In addition, the SCNF contains designated critical habitat for Snake River sockeye salmon, designated critical habitat and Essential Fish Habitat (EFH) for Snake River spring/summer Chinook salmon, and proposed designated critical habitat for bull trout. Salmon and steelhead are under the jurisdiction of the National Marine Fisheries Service (NMFS) and bull trout are under the jurisdiction of the USFWS. These lists are subject to change as species are added, removed, or re-categorized.

The populations of these four species have been declining. Habitat degradation has been shown to play an important role in this decline. These species occur in habitats adjacent to areas that have been invaded by noxious weeds or are potentially vulnerable to invasion, and could potentially be affected by the presence and/or treatment of invasive plants . The listing status, biological requirements, trend and potential occurrence of the four federally listed fish species listed in this section are available in the Salmon-Challis NF Invasive Plant Treatment Fisheries Specialist Report, pages 26-52.

Table 3-38: ESA Listed Fish Species of the Salmon-Challis National Forest

Common Name	Scientific Name	Habitat	Federal Status
Snake River Sockeye Salmon	*Oncorhynchus nerka*	Mountain lakes; low to mid-gradient creeks and rivers; range from high mountain spawning streams and lakes to Pacific Ocean; cold, clear, well-oxygenated water	Endangered
Snake River Spring/Summer Chinook Salmon	*Oncorhynchus tshawytscha*	Low to mid-gradient creeks and rivers; range from high mountain spawning streams to Pacific Ocean; cold, clear, well-oxygenated water	Threatened
Snake River Basin Steelhead	*Oncorhynchus mykiss*	Low to mid-gradient creeks and rivers; range from high mountain spawning streams to Pacific Ocean; cold, clear, well-oxygenated water	Threatened
Columbia River Bull Trout	*Salvelinus confluentus*	Large woody debris; undercut banks; boulder, and pools; clean, cold, well-oxygenated water	Threatened/ MIS

USDA Forest Service Intermountain Region Sensitive Species

The Forest Service Manual directs the Regional Forester to identify sensitive species for each National Forest where species viability may be a concern. The Intermountain Region (R4) Sensitive Species List was updated on July 27, 2011. Fish species that may reside within the project area that appear on Region 4 Sensitive species list are:

Westslope Cutthroat Trout

Westslope cutthroat trout (*Oncorhynchus clarki* var *lewisi*) is listed as a Forest Service Intermountain Region sensitive species and as a priority Species of Special Concern by the State of Idaho because of habitat degradation and declines of genetically pure populations (IDFG 2001). This species is widely

distributed throughout the SCNF. However, like bull trout, it is largely dependent on high-quality habitat for survival, including cold water, numerous deep pools, and streambeds that are relatively free of sediment (Quigley and Arbelbide 1997). The strongest populations of westslope cutthroat trout occur in watersheds less influenced by roads or land management practices. Stocked non-native species of cutthroat and rainbow trout can also adversely affect westslope cutthroat trout by hybridization. Migratory populations of this species are most significantly affected by the loss of viable habitat (Quigley and Arbelbide 1997).

Big Lost River Mountain Whitefish

The Intermountain Regional Forester has designated the Lost River population of mountain whitefish (*Prosopium williamsoni*) as a sensitive species. The Big Lost River Mountain whitefish was petitioned for listing (72 FR 59983) but was determined by the USDI FWS to not be warranted in 2010 (75 FR 17352). This population of mountain whitefish occurs on lands administered by the SCNF on the Lost River Ranger District.

Mountain whitefish are members of the family Salmonidae. They are found in rivers and lakes in mountainous areas of western North America. They are relatively common and widespread in most river basins in Idaho and, in general, occur in large low gradient mainstem rivers. Mountain whitefish in the Big Lost River area are in a “sink” drainage that lost surface connection the Snake River system approximately 10,000 years ago and are physically isolated from other whitefish populations (USDI FWS 2010).

Aquatic Management Indicator Species

Management Indicator Species (MIS) in the SCNF are considered to be key species that represent life forms and have habitat requirements similar to other groups of plants or animals on the Forest. MIS are selected to represent special habitats, major habitat components of the SCNF, economically or socially important species, and ecological indicators, and are further selected based upon monitoring capability. Bull trout are the designated Management Indicator Species for aquatic habitats in the SCNF.

Other Rare and Sensitive Aquatic Species

Pacific Lamprey

This species (*Lampetra tridentata*) is a native anadromous lamprey. Like anadromous fish, this lamprey is believed to have historically migrated to all waters accessible to anadromous salmonids. They are a predacious parasite that feed off live fish. Lampreys require low gradient water with muddy bottoms, where young lampreys will burrow into the mud and consume microscopic plants. Returns of adults to the Snake River Basin have declined to less than a few hundred individuals. Because of this, the State of Idaho has listed Pacific lamprey as an endangered nongame species (IDFG 2001).

White Sturgeon

The Snake River population of this species (*Acipenser transmontanus*) has been identified by USFWS and the State of Idaho as a Species of Concern. It has been adversely affected by hydropower projects through migration barriers and population fragmentation (Quigley and Arbelbide 1997) and by overfishing (IDFG 2001). The Snake River population of white sturgeon occurs in the Snake River

and in the mainstem Salmon River upstream to Clayton. This large, long-lived, bottom-oriented species is associated with large cool rivers (Simpson and Wallace 1978). It spawns in late spring/early summer over a rocky bottom in swift current near rapids. White sturgeon may not reach sexual maturity and spawn until 10 to 15 years of age.

Introduced Salmonids

Non-native salmonids have been introduced in the SCNF since the late nineteenth century to enhance angling opportunities. Arctic grayling (*Thymallus arcticus*) and golden trout (*Oncorhynchus aguabonita*) have been introduced to the SCNF to enhance angling opportunities in high mountain lakes. Brook trout (*Salvelinus fontinalis*) and rainbow trout (*O. mykiss*) have also been introduced to SCNF lakes and streams. Although they have strong populations within the SCNF, the latter two introduced salmonids pose risks of hybridization with native salmonids and compete for food and space.

Recreational Fisheries

Although most fisheries surveys focus on the occurrence of species that are endangered, threatened, sensitive, or a Species of Concern (species listed under the ESA plus those so designated by the Forest Service and State of Idaho), a number of fish species provide recreational opportunities in the SCNF. These include hatchery stocks of Chinook salmon and steelhead, and rainbow trout, brook trout, golden trout, Arctic grayling, and mountain whitefish. Hatchery-spawned, non-ESA steelhead and Chinook salmon that return to the Salmon River as adults support a broad recreational fishing base within the basin, including areas within the SCNF (Quigley and Arbelbide 1997).

Non-Game Species

Commonly occurring nongame fish species that are important members of aquatic communities in the SCNF include northern pikeminnow (*Ptychocheilus oregonensis*), redside shiner (*Richarsonius balteatus*), bridgelip sucker (*Catostomus columbianus*), largescale sucker (*Catostomus macrocheilus*) , chisel-mouth (*Acrocheilus alutaceus*), sculpin (*Cottus* spp.) and dace (*Rhinichthys* spp). These species, as well as all other fish species described above, may occur in habitats adjacent to areas that have been invaded by noxious weeds or are potentially vulnerable to invasion. These stream and lake habitats could potentially be affected by the presence of invasive plants and/or land management practices associated with invasive plants control.

3.4.6. Environmental Consequences

3.4.6.1. Alternative 1-No Action

Direct and Indirect Effects

With the expected continued spread of invasive plants under the No Action alternative there would be an increased potential for both short- and long-term soil erosion and stream sedimentation at infested sites. This can directly and indirectly adversely affect both aquatic habitat and associated fish and aquatic invertebrate populations. These adverse effects would likely be greatest in the northern portion of the SCNF within the North and Salmon Invasive Plant Management Zones, where there are extensive infestations of spotted knapweed.

The Forest Service (USDS Forest Service 1999; USDA Panhandle National Forest 2001) noted that the establishment of invasive plants such as knapweed and sulphur cinquefoil within or adjacent to riparian habitats could increase overland runoff and sediment yield from such habitats, citing studies by Lacey et al. (1989) who reported a three-fold increase in sediment yield and a 50 percent increase in runoff at a knapweed-infested site compared to a non-infested site. Studies on the Lolo National Forest in western Montana showed that a site with 80 percent knapweed cover yielded five times the amount of sediment as sites covered with bunchgrass (Hickenbottom 2000, in USDA Lolo National Forest 2001). These same studies estimated that the effects of a 20-minute thunderstorm (100-year event intensity) occurring on 1,648 acres of big game winter range infested with spotted knapweed could produce an additional 160 tons of sediment compared to an invasive plant-free site.

Increased sediment delivery to drainages can directly and indirectly affect aquatic resources through the sedimentation of stream substrates and increased levels of turbidity and suspended sediment in the water column. Increased sedimentation can cause a degradation of stream bottom habitat used by aquatic insects such as, mayflies, and stoneflies that are important fish foods; a subsequent reduction in aquatic insect abundance and diversity; a reduction in the permeability among interstitial spaces within spawning gravels that inhibits the flow of oxygenated water and the removal of metabolic wastes; a subsequent reduction in spawning success, hatching success, and fish production; and a reduction in the interchange of surface and subsurface waters in the hyporheic zone beneath the stream channel (Nelson et al. 1991). Substantially increased sedimentation can eliminate or reduce the depths of pools that provide important year-round cover for juvenile, sub-adult, and adult fish. If severe enough, increased sediment loads can cause the erosion and migration of stream channels (Chamberlin et al. 1991), and the subsequent degradation of aquatic and riparian habitat.

Elevated turbidity and suspended sediment levels caused by increased sediment delivery can have sub-lethal and acute effects on fish. Nelson et al. (1991) reported that suspended sediment concentrations of 1,200 milligrams per liter (mg/L) cause mortalities in under yearling salmonids, while suspended sediment concentrations as low as 100 mg/L up to 1,000 mg/L are sometimes associated with a general reduction in fish activity, impaired feeding, reduced growth, downstream displacement, and decreased resistance to other environmental stressors. (A concentration of 1 mg/L equals 1 part per million or ppm.) Fish and fish food production can be affected by the abrasive effects of very fine sediment on fish embryos and fry and on immature aquatic insects. In addition, very turbid waters can exhibit increased temperatures because of the water's capacity to retain more heat. This can affect those fish and invertebrate species that have the most restrictive cold-water or cool-water thermal requirements.

The potential degradation or loss of riparian habitat from invasive plant infestation can be especially important in smaller drainages because of the many direct and indirect influences riparian habitat has on the quality of aquatic habitat. Murphy and Meehan (1991) reported that riparian habitat can form a protective canopy that provides overhead cover for fish and moderates the extreme effects of air temperatures during summer (helps to cool streams) and winter (helps to insulate streams). Riparian habitat also helps reduce soil erosion and filters sediment before it enters streams, stabilizes streambanks, and allows for the formation of undercut banks that provide cover for fish. In addition, riparian habitat contributes litter (nutrients and food for invertebrates) and woody debris (instream cover) to drainages, and it provides habitat for insects that fall to the water's surface and are consumed by fish (Murphy and Meehan 1991).

Aquatic resources potentially impacted by the direct and indirect effects of increasing invasive plant infestations in the SCNF include all of the special status, rare, sensitive, introduced, recreational, nongame, and other MIS fish species described in the Affected Environment section of this report. Potentially at-risk resources also include aquatic invertebrate species. The greatest potential for impacts from increased sediment delivery and possibly riparian degradation may be to the anadromous and native resident salmonids, especially protected and/or sensitive species such as Chinook salmon, sockeye salmon, steelhead, bull trout, and westslope cutthroat trout. These species have relatively narrow habitat requirements, including the need for clean, cold, well-oxygenated, interconnected water and/or gravels for spawning, egg incubation, rearing, migration, and/or adult success (Bjornn and Reiser 1991). Site-specific impacts from erosion and sediment delivery would depend on the slope, soil characteristics, precipitation amount and pattern, distance to water, riparian buffer health and extent, and the species and life stages present.

There would be no potential negative effects or risks to fisheries resources or aquatic habitats from herbicide application, or short-term increases in erosion and sediment delivery to drainages caused by mechanical treatments (soil disturbance) under the No Action alternative.

Effects to Federally-Threatened and Endangered and Forest Service Region 4 Sensitive Fish Species

Implementation of Alternative 1 would not be considered likely to adversely affect Federally listed species occurring within the SCNF non-wilderness project area, including: Snake River spring/summer Chinook salmon, Snake River sockeye salmon, Snake River Basin steelhead, and Columbia River bull trout. Implementation may result in some localized increases in site erosion and stream sedimentation in association with expanding invasive plant infestations, as described above particularly within the northern portions of the Forest. Indirect effects of increased stream sediment would be reduced habitat suitability of substrate habitats for sediment intolerant fish food organisms. Impacts would be localized and limited to existing significant near-stream invasive plant infestations, and areas of new infestations. There would be no potential negative effects or risks to TES fish species or their critical habitats from herbicide application, or short-term increases in erosion and sediment delivery to drainages caused by mechanical treatments or rehabilitation/restoration activities (soil disturbance) under the No Action alternative. Existing biological releases may produce minor localized beneficial effects to the fish food base, but no additional benefits would be realized in the absence of ongoing releases. Effects to Forest Service Region 4 sensitive westslope cutthroat trout and their aquatic habitats are similar to those identified for Federally-listed species and critical habitats. Implementation of the No Action program may impact individual westslope cutthroat trout aquatic habitats through locally elevated sedimentation related to reduced soil stability in invasive plant infested areas, but the level and scope of impacts would not likely contribute to a trend towards Federal listing, cause a loss of viability to the population, or be expected to result in a downward trend for the species.

Effects to MIS Fish Species

Population trends for the SCNF's aquatic Management Indicator Species in the SCNF are discussed in the Affected Environment section of this document. Under the No Action alternative no active invasive plant treatments would be conducted on SCNF lands. Direct and indirect effects to bull trout under Alternative 1 are as identified within the preceding TES species discussion above. These

effects would not be expected to be of sufficient nature or magnitude to result in measureable influence on the past or future trend of bull trout populations in the SCNF.

Cumulative Effects

With the exception of road right of way treatments conducted under agreements with Lemhi, Custer, and Butte Counties, invasive plant treatment activities would not occur on Salmon-Challis National Forest non-wilderness lands of the action area under the No Action alternative. Active invasive plant treatments, including ground based herbicide application, mechanical control, and biological control releases, would continue to occur on private, county, state and Bureau of Land Management lands through actions conducted by Cooperative Weed Management Area (CWMA) participants. Analysis of cumulative effects will therefore address an analysis area encompassing all land ownerships within the Upper Salmon River, Little Lost River, and Big Lost River Basins.

Current ongoing and foreseeable SCNF forest management activities are identified in Appendix H of this document. Identified actions serving as the baseline condition for cumulative effects include timber, minerals, range, recreation and travel management, along with fire history. Herbicide spraying operations on non-Forest lands are also identified.

A lack of active treatment of invasive plants in the SCNF non-wilderness lands under the No Action alternative, combined with continuing non-forest treatments conducted by the three CWMAs, would be expected to result in some localized eradication, control, and containment of invasive plants within non-forest lands of the Upper Salmon River, Little Lost River and Big Lost River basins. However, infestations on National Forest System lands would be expected to continue to increase. This would impede the efficacy of ongoing CWMA efforts to eradicate, control, or contain new invasive plants that have spread to adjacent non-forest from SCNF infestations. The resultant continuing spread of invasive plants within the three basins could potentially adversely affect aquatic and riparian habitats both on and off National Forest lands through increased erosion and sediment delivery to drainages. The potential for adverse cumulative effects on aquatic resources would be greatest in the northern portion of the SCNF within the North and Salmon Invasive Plant Treatment Zones and on adjacent non-National Forest lands because of extensive spotted knapweed infestations on national forest lands which would not be treated.

CWMA herbicide applications to private, state, county or Bureau of Land Management lands adjacent to SCNF non-wilderness lands would continue to occur under the No Action alternative, as would chemical applications on private lands by landowners within the three basins. Potential cumulative effects to National Forest System lands would be primarily limited to areas downstream of private inholdings where there would be the potential for adverse effects to aquatic and riparian resources if an herbicide spill or wind-drift-related impact occurred close to Forest Service boundaries.

3.4.6.2. Action Alternatives

Effects Common to All Action Alternatives

Each of the action alternatives explored by SNCF for the FEIS include an Integrated Weed Management approach to invasive plant management. IWM under the action alternatives incorporates the use of biological, chemical and mechanical treatment options, as well as rehabilitation and restoration practices. These options are implemented singly or in combination

with each other to manage invasive plants. Effects of mechanical and biological treatments and rehabilitation/restoration practices are similar among the action alternatives. Chemical treatment actions vary significantly between the action alternatives and will be discussed individually by alternative. All common biological, mechanical and rehabilitation/restoration actions implemented under the action alternatives would result in benefits to aquatic habitat health over the long from re-establishment of desirable vegetation that would reduce adverse erosion and sediment delivery to forest waters. A reduction of invasive plants and establishment of desirable vegetation would benefit watershed health and reduce potential for future invasive plant encroachment into riparian areas. Short-term localized impacts to individual drainages may occur, however under the various treatment methods, and may be specific to individual treatment methods, as identified below.

Biological Treatments

Biological control agents have been released extensively in the SCNF. The Current Action includes biological control releases over an average of approximately 400 acres annually (FACT Forest Activity Tracking System three year average for 2010-2012). The SCNF's current use of biological treatments is limited to the use of classical biological control techniques. The SCNF also uses biological control agents to supplement herbicide control in larger infestations where treatment cannot be accomplished regularly due to the cost of treatment.

Direct and Indirect Effects of Biological Control

The release of biological agents to control invasive plants should have no adverse effect on aquatic resources. The biological controls target specific invasive plants as a host and would not compete for food with aquatic organisms, but they may provide an incidental food source for fish where infestations occur near stream channels. As there are no biological control agents in use in the SCNF that are known to attack non-target plants, there would be no expected negative effects to native riparian vegetation.

Effects to Federally-Threatened and Endangered and Forest Service Region 4 Sensitive Fish Species

Implementation of biological invasive plant control releases under the action alternatives would not result in effects of a scope or magnitude which would be considered likely to adversely affect Federally-listed species occurring within the SCNF non-wilderness project area. As identified above, biological releases may provide a slight beneficial effect in contributing an additional incidental fish food source to aquatic environments in and around release sites.

Effects to Forest Service Region 4 sensitive westslope cutthroat trout and their aquatic habitats are similar to those identified for Federally-listed species and critical habitats, and would not likely contribute to a trend towards Federal listing, cause a loss of viability to the population, or be expected to result in a downward trend for the species.

Effects to MIS Fish Species

Effects to MIS fish species from biological control releases under the action alternatives would be as described within the TES effects discussion above. The slight localized beneficial effects identified with biological releases would not be of sufficient scope or magnitude to have a measureable influence on future short- or long- term trend of bull trout populations in the SCNF.

Mechanical Treatments

Mechanical control methods include hand pulling, grubbing, hoeing, cutting and mowing, burning, and torching. The SCNF does not currently use or propose to use chaining or disking as a method to control non-native invasive plant species. Mechanical control methods are often combined with herbicide applications. Once herbicide application has reduced the size and density of the infestation, integration of mechanical control helps to reduce the risk of further spread. Mechanical treatments are also used in combination with reseeding or other restoration efforts.

Direct and Indirect Effects of Mechanical Control

Both short-term and long-term localized impacts to individual drainages may occur in association with mechanical treatment methods. Short term effects of mechanical invasive plant control may include a temporary increase the amount of bare ground. Commonly, dead plant material from plants that were mechanically removed breaks down and covers the soil surface, providing a protective litter layer. However, where this does not occur, increased amounts of bare ground could result in a temporary increase in soil erosion and associated sediment delivery to stream channels, especially during a high intensity rain event. This is usually confined to very small areas since mechanical control is practiced only a small scale.

In the long term, however, actions implemented to reduce invasive plant infestations would result in benefits to aquatic habitat health from re-establishment of desirable vegetation that would reduce adverse erosion and sediment delivery to forest waters. A reduction of invasive plants and establishment of desirable vegetation would benefit watershed health and reduce potential for future invasive plant encroachment into riparian areas.

Effects to Federally-Threatened and Endangered and Forest Serivce Region 4 Sensitive Fish Species

Implementation of mechanical control activities under the action alternatives would not result in effects of a scope or magnitude which would be considered likely to adversely affect Federally-listed species occurring within the SCNF non-wilderness project area. Short-term localized increases in soil erosion and sediment delivery to critical habitat stream channels could occur in association with increases in bare ground areas at mechanical treatment sites. Subsequent re-establishment of desirable vegetation however, would result in a long term reduction of erosion and sediment delivery at these sites relative to pre-treatment conditions.

Effects to Forest Service Region 4 sensitive westslope cutthroat trout and their aquatic habitats are similar to those identified for Federally-listed species and critical habitats. Implementation of mechanical treatments may impact individual westslope cutthroat trout aquatic habitats through locally elevated sedimentation related to soil disturbances at treatment sites, but the level and scope of impacts would not likely contribute to a trend towards Federal listing, or cause a loss of viability to the population or species or be expected to result in a downward trend for the species.

Effects to MIS Fish Species

Effects to MIS fish species from mechanical control treatments under the action alternatives would be as described within the TES effects discussion above. Effects from mechanical treatments would be related to temporary increases in bare ground areas, with resultant localized increases in soil erosion and sediment delivery to stream channels until sites are re-vegetated with native plant

species. These temporary and localized effects would not be expected to be of sufficient nature or magnitude to result in measureable influence on future short- or long- term trend of bull trout populations in the SCNF.

3.4.6.3. Alternative 2-Current Action

Currently there approximately 49,000 acres of mapped infestations of invasive plant species on the Salmon-Challis National Forest, exclusive of the Frank Church-River of No Return Wilderness Area. The Current Action is designed to prevent the establishment of new invasive plant species, prevent further spread of existing invasive plants , and maintain native plant communities. The Current Action implements an adaptive Integrated Weed Management (IWM) strategy to eradicate or control existing or newly discovered invasive plants. The IWM strategy is derived from Forest Service Manual Direction (FSM 2900) and through national and regional strategic frameworks and management plans (USDA Forest Service 2013; USDA Forest Service R4 2014).

The adaptive IWM program utilizes a variety of tools, used alone or in combination, to treat invasive plants in the SCNF. Control can often require repeat treatments and monitoring of control efficacy. Invasive plants treatment methods implemented under the Current Action include ground-based herbicide application, mechanical treatment, biological control releases, cultural methods, and combinations of these treatments.

Table 3-39: LC50, MATC and NOEL/NOEC Concentrations of Herbicides Used by the Salmon-Challis National Forest (Alternative 2)

Herbicide (Test Species)	96-Hour LC50 (mg/L)	LC50/10 (mg/L)	MATC[1] (mg/L)	NOEL[2]/NOEC[3] (mg/L)
2,4-D Amine	420	42	4	10 NOEL
Chlorsulfuron	250	25	46	32 NOEC
Clopyralid	103	10.3	44	23 NOEL
Dicamba	28	2.8	1.12	56 NOEL
Glyphosate	140	14	0.04	1 NOEL
Imazapic	>100	>10	>4	100 NOEC
Metsulfuron-methyl	>150	>15	>6	100 NOAEL[4]
Picloram	3.5	0.35	0.12	0.29 NOEL
Sulfometuron methyl	>148	>14.8	5.9	>148 NOEL
Triclopyr: triethylamine salt (TEA)	420	42	6	-

[1]MATC: Maximum Acceptable Toxicant Concentration
[2]No Observed Effect Level
[3]No Observed Effect Concentration
[4]No Observed Adverse Effect Level
2,4-D Amine: 96hr LC50 and MATC from Mayer and Ellersieck (1986); NOEL from SERA (2001)
Chlorsulfuron: 96hr LC50 from Smith (1979) in SERA (2004); MATC and NOEC for RBT fingerlings from Pierson (1991) in SERA (2004)
Clopyralid: 96hr LC50 and NOEL from SERA (1999); MATC from Mayer and Ellersieck (1986)
Dicamba: 96hr LC50 and MATC from Mayer and Ellersieck (1986); NOEL from McAllister et al (1985) in SERA (2004)
Glyphosate: 96hr LC50 and NOEL from SERA (1996); MATC from Mayer and Ellersieck (1986)
Imazapic: 96hr LC50 and NOEC from SERA (2004); MATC = LC50/25 per Mayer and Ellersieck (1986);

Metsulfuron-methyl: 96hr LC50 and NOAEL from Muska and Hall (1982) in SERA (2004); MATC = LC50/25 per Mayer and Ellersieck (1986)
Picloram: 96hr LC50 and NOEL from Woodward (1976,1979);MATC from Mayer and Ellersieck (1986)
Sulfometuron-methyl: 96hr LC50 and NOEL from Brown (1994) in SERA (2004); MATC = LC50/25 per Mayer and Ellersieck (1986)
Triclopyr TEA: 96hr LC50 from Wan et al (1987) in SERA (2011) MATC = LC50/25 per Mayer and Ellersieck (1986); No NOEL value identified.

Two other sets of values or criteria listed in Table 3-39 are believed by researchers to protect aquatic organisms. In the first set of criteria, the EPA (EPA 1986) recommends that the 96-hour LC50 value be divided by 10 to set a standard for herbicide concentrations that will protect aquatic organisms (USDA Forest Service 1999; USDA Panhandle National Forest 2001). In the second set of criteria developed by the USFWS (Mayer and Ellersieck 1986), the maximum acceptable toxicant concentration (MATC) represents the acute toxicity value of either rainbow trout or Daphnia spp. (a type of water flea), whichever is less, to a specific herbicide divided by 25. The USFWS believes that if herbicide concentrations are equal to or less than the MATC, then all aquatic species will be reasonably protected; certain individuals may still react to the herbicide but the overall population is considered safe (Mayer and Ellersieck 1986). The MATC value is generally lower than the LC50 divided by 10 value. The MATC method is comparable to methods used in risk assessments conducted by the Forest Service and complies with directions outlined in the Forest Service Handbook (1995).

The LC50 divided by 10 values and the MATC values listed in Table 3-39 are used as criteria in the following assessment to identify the potential for herbicide-related impacts on aquatic organisms in the SCNF. Both methods have been used in recent NEPA weed management assessment documents prepared by the Forest Service. The LC50 divided by 10 criteria were used for the FC-RONR Wilderness in central Idaho (USDA Forest Service 1999) and the Sandpoint Ranger District in northern Idaho (USDA Panhandle National Forest 2001). The MATC criteria were used for the Beaverhead-Deerlodge National Forest (USDA Beaverhead-Deerlodge National Forest 2001) and the Flathead National Forest (USDA Flathead National Forest 2000) in western Montana. Projected values are also compared against NOEL values in the following assessment. NOEL values usually exceed calculated MATC values.

Herbicides currently used in the SCNF may also contain “inert” ingredients, including surfactants, which are not expected to have any significant effect to fisheries resources. The dyes and other adjuvants utilized by the SCNF and identified in Appendix D are described as having little effect on fish or wildlife populations. Project design criteria for herbicide applications are expected to minimize adverse impacts, if any, of these other ingredients.

Direct and Indirect Effects

Direct and Indirect Effects of Ground-Based Terrestrial Invasive Plant Treatments

Mechanisms of potential entry of herbicides to aquatic ecosystems during ground or aerial treatment of terrestrial invasive plants include surface runoff, leaching through soils, accidental spills, and wind drift. The potential impact of an herbicide on aquatic organisms depends on the toxicity characteristics and exposure concentration of that herbicide.

Results of water monitoring studies in association with herbicide applications in Region 5 of the Forest Service illustrate the effectiveness of BMPs and buffers when properly implemented (Bakke

2001). Of 140 surface water samples collected on these Forests during reforestation and noxious weed eradication projects using ground-based applications of glyphosate and triclopyr, there were no detections of glyphosate in any samples taken after reforestation projects that were not ascribed to contamination. The one project with a detection of glyphosate involved treatment of noxious weeds within the riparian zone. Even here, only one of twelve samples had a detection of glyphosate and that was at a low level of 15 micrograms per liter, which is below any level of concern for human health or aquatic resources (Bakke 2001). The few positive detections of triclopyr in non-accidental or erroneous applications in water monitoring were all at levels below any aquatic Levels of Concern (highest 2.4 micrograms per liter). The highest level of triclopyr detected (82 micrograms per liter) was the result of an absence of a no-treatment buffer on an ephemeral stream, and even this level did not represent a substantial risk of harm to humans or the environment (Bakke 2001).

Undisturbed forests and grasslands in the SCNF are typically associated with infiltration-dominated sites. The overland transport of herbicides applied to smaller invasive plants infestations occurring on this type of landscape would be expected to be minimal. However, many of the infestations in the SCNF are associated with roads, trails, paths, and other areas where the soil has been disturbed and/or compacted. Road prisms, road cuts, and road fills are runoff dominated features. They enhance runoff by concentrating flows on compacted road surfaces and in ditches, and in some cases by intercepting groundwater flow from cut slopes (USDA Panhandle National Forest 2001, USDA Beaverhead-Deerlodge National Forest 2001, USDA Lolo National Forest 2001). Compacted, coarse-sized material with low organic matter that is used to create road fill slopes can also contribute to increased runoff. In addition, the Forest Service (USDA Forest Service 1999; USDA Panhandle National Forest 2001, USDA Beaverhead-Deerlodge National Forest 2001, USDA Lolo National Forest 2001) noted that, in general, infested areas could increase overland runoff, citing studies by Lacey et al. (1989) who reported a 50 percent increase in runoff at a knapweed-infested site compared to a non-infested site. In these settings in the SCNF, the potential for the inadvertent introduction of herbicides to streams would be expected to occur primarily via surface runoff.

Worst-Case Scenarios

Spotted knapweed is by far the predominant invasive plant occurring in the SCNF, comprising approximately 84 percent of the total infestations within the project area. Under the Current Action program, there are five herbicides that can be used to treat spotted knapweed. They include 2,4-D amine, clopyralid, glyphosate, picloram and triclopyr. The range of toxicities of these five herbicides provides a broad representation of possible adverse effects if herbicides inadvertently enter aquatic ecosystems. One of these herbicides, picloram, represents potentially worst-case conditions for aquatic organisms both because of higher toxicity to fish, and its persistence and mobility in the environment compared to the other herbicides.

To illustrate the potential effects of herbicide use on Forest aquatic resources and habitats, four worst-case situations involving ground application of herbicides in the SCNF are analyzed. They include scenarios of inadvertent entry of herbicides into aquatic ecosystems through surface runoff, leaching through soils, accidental spills, and wind drift. These four situations are generally regarded as worst-case examples because of the extensive list of project design criteria that are implemented as an integral component of the Current Action to avoid or minimize the potential for worst-case adverse effects to occur. For example, BMPs and design criteria are included to avoid or minimize the possibility of extreme rain events occurring after herbicide spraying, since such an occurrence could cause a runoff event. The Current Action's design criteria would avoid occurrence of these

worst-case conditions. These site-specific processes are designed to avoid or minimize the potential for adversely affecting SCNF resources, especially sensitive aquatic resources.

Surface Runoff Scenarios

Five worst-case scenarios involving surface runoff and the inadvertent entry of herbicides used to treat invasive plants into drainages are analyzed in the following text. The first of these analyses examines the ground-based application of picloram to treat spotted knapweed in the North Fork Salmon River Watershed. Inventoried infestations of spotted knapweed within the North Fork Ranger District, including the North Fork Salmon River drainage, constitute by far the largest infestations in the SCNF. The second worst-case scenario examines the ground-based application of 2,4-D amine to treat spotted knapweed and Canada thistle in the Little Lost River Watershed.

The final three worst-case scenarios examine the effects of herbicide treatment on three comparatively small drainages associated with 6th order HUCs in the North Fork Salmon River Watershed (Hull Creek), the Challis Creek Watershed (Eddy Creek), and the Lemhi River Watershed (Little Eightmile Creek).

Picloram—North Fork Watershed; (HUC 1706020306):

This worst-case analysis involves the ground-based application of picloram to treat 50 acres of spotted knapweed in one day during summer. Picloram was selected for analysis because of its relatively high toxicity compared to other herbicides (Table 3-39) and because of its persistence and mobility in the environment. The ground-based herbicide treatment of 50 acres in a single day rather than over one week is regarded as an aggressive rate of invasive plant treatment. Quartzite is the predominant soil type in the North Fork Watershed and is one of the more permeable soil types.

The Forest Service (1999) cited field studies of pesticide spray operations that showed pesticide input to streams varied from non-detectable levels to 6 percent of the amount applied. The Forest Service (USDA Panhandle National Forest 2001) also cited reviews by Rice (1990), which showed that a maximum of 10 percent of picloram applied on a runoff-dominated site could potentially enter a stream in a 6-hour period in the event of rain. By comparison, only 1 percent of picloram applied on an infiltration-dominated site could potentially enter a stream via surface runoff in a 6-hour period in the event of rain. The Forest Service (USDA Beaverhead-Deerlodge National Forest 2001) reported that with picloram, the risk for contamination is generally greatest with the first storm following herbicide application that results in overland flows. The Forest Service (USDA Beaverhead-Deerlodge National Forest 2001) also reported that herbicide concentrations in streams generally peak in a 4- to 6-hour period following a runoff-generating event.

At an application rate of 0.50 pound per acre, a total of 25 pounds of picloram would be delivered to the 50-acre treatment site. Assuming as a worst case that 10 percent of the applied picloram inadvertently runs off into a nearby drainage over a 6-hour period, that drainage would receive 2.5 pounds of picloram. The major drainage in the North Fork Watershed is the North Fork Salmon River. Average monthly flows during late summer/fall when the herbicide could potentially enter the North Fork because of a rainstorm vary from 19 cubic feet per second (cfs) in August to 14 cfs in October (USDA Salmon-Challis NF 1998). If 2.5 pounds of picloram enter the North Fork Salmon River over a 6-hour period in October, the resultant concentration would be 0.13 milligram of picloram per liter of river water (0.13 mg/L). This value is less than both the LC50 divided by 10 value (0.35 mg/L) and the NOEL value (0.29 mg/L) for picloram listed in Table 3-39 and essentially the

same as the MATC value (0.12 mg/L). In the event of such a worst-case occurrence involving picloram, populations of aquatic life in the North Fork Salmon River, which include the threatened Snake River spring/summer Chinook salmon, Snake River Basin steelhead and Columbia River bull trout, and the sensitive westslope cutthroat trout, would be considered safe according to definitions for these protective criteria. Resultant concentrations in tributaries to the North Fork Salmon River or any other drainage in the SCNF that receives this same amount of picloram from a runoff-dominated site over a 6-hour period would not exceed the NOEL (0.29 mg/L) level if flows are at least 7 cfs.

Using these same assumptions and an application rate of 1 (rather than 0.50) pound of picloram per acre on a 50-acre runoff-dominated site, the resultant average concentration of picloram in the North Fork Salmon River in October during a 6-hour rainfall event would be approximately 0.26 mg/L. This value is slightly less than both the LC50 divided by 10 value and the NOEL value, but exceeds the MATC value for picloram of 0.12 mg/L (Table 3-39). On infiltration-dominated sites where no more than 1 percent of the picloram applied could potentially enter a stream via surface runoff, the resultant average concentration in the North Fork Salmon River would be one-tenth what it would be for drainages receiving input from runoff-dominated sites. For the examples given above over a 50-acre treatment area, the resultant average concentration of picloram in the North Fork Salmon River in October would be 0.013 mg/L when applied at a rate of 0.5 pound per acre and 0.026 when applied at a rate of 1 pound per acre at an infiltration-dominated site. Both of these concentrations would be considerably less than the LC50 divided by 10, the NOEL, and the MATC values for picloram listed in Table 3-39. No adverse effects on populations of aquatic resources would be expected under these conditions.

The predominant soil type in the North Fork drainage is quartzite (88 percent of the total), followed by granitic (5 percent), volcanic (4 percent), and valley bottom (3 percent) soil types. Quartzite soils are one of the more permeable soil types and would typically be associated with an infiltration-dominated site. The previous worst-case analysis describing picloram concentrations associated with infiltration-dominated sites would therefore be considered most applicable to the North Fork drainage.

2,4-D amine—Upper Little Lost Watershed (HUC 1704021705):

This worst-case analysis involves the ground-based application of 2,4-D amine to treat 58 acres of Canada thistle and spotted knapweed in one day during the summer. These infestations are located in the Lost River Ranger District in the Upper Little Lost Watershed of the Little Lost River drainage. The herbicide 2,4-D amine can be used to treat both of these species. This analysis is believed to represent a worst-case scenario, but for the southern portion of the SCNF rather than the northern portion as in the previous scenario. It assumes that a relatively large acreage of invasive plants (at least for this portion of the SCNF) would be treated in a single day within a single HUC 5, and that a maximum of 10 percent of the applied herbicide on a runoff-dominated site would enter a stream via surface runoff over a 6-hour period. At an application rate of one pound of 2,4-D amine per acre, a total of 58 pounds of 2,4-D amine would be delivered to the 58-acre treatment site in one day. This analysis assumes that 10 percent (5.8 pounds) of the applied 2,4-D amine runs off during a rainfall event and enters a headwater tributary to the upper Little Lost River over a 6-hour period. It also is assumed that this event occurs in October during a typical low-flow period when the average tributary flow is only 2 cfs. The resultant average concentration of 2,4-D amine in the headwater tributary would be 2.2 mg/L. This value would be less than the LC50 divided by 10 value (42 mg/L), the MATC value (4 mg/L), and the NOEL value (10 mg/L) for 2,4-D amine (Table 3-39), and

populations of aquatic resources would be considered safe in the event such a worst-case situation occurred.

On infiltration-dominated sites where no more than one percent of the 2,4-D amine could potentially enter a stream via surface runoff, the resultant average concentration of 2,4-D amine in the headwater tributary flowing at 2 cfs would be 0.22 mg/L, or one-tenth what it would be if herbicide input was from a runoff-dominated site. This analysis indicates that for both runoff- and infiltration-dominated sites in the southern SCNF and in other portions of the SCNF where invasive plant infestations (and potential herbicide uses) are far less extensive than in the northern SCNF, populations of aquatic life in the upper Little Lost River drainage would be considered safe.

Soil types in the Upper Little Lost Watershed reflect a mixed geology, with sedimentary soils most abundant (45 percent of the total) and lesser amounts of volcanic (29 percent) and quartzite (26 percent) soils present. Sedimentary and volcanic soils generally tend to be less permeable than quartzite soils. This suggests, based on predominant soil characteristics, that treatment areas in the Upper Little Lost HUC 5 would tend to be runoff-dominated sites.

Low Flow Watersheds

North Fork Watershed, Hull Creek (HUC 170602030606):

Hull Creek has a seasonal low flow of 0.72 cfs and drains 8,419 acres. Spotted knapweed is by far the dominant invasive plant species and is much more abundant in this area of the SCNF than in other areas. Quartzite soils, which are relatively permeable, are the predominant soil type in this area of the SCNF. Using the same assumptions for runoff- and infiltration-dominated sites during a rainfall event as in the previous analyses, applying picloram at rates of 0.50 and 1 pound per acre to treat spotted knapweed, and given a seasonal low flow in Hull Creek of 0.72 cfs, the maximum number of acres that could be treated in one day without exceeding the MATC value for picloram (0.12 mg/L, (Table 3-39) which is considered protective of aquatic life, was calculated. These calculations show that on a runoff-dominated site in the Hull Creek watershed, the maximum number of acres that could be treated in one day with picloram at application rates of 0.50 and one pound per acre without exceeding the MATC value would be approximately 2 acres and one acre, respectively. On an infiltration-dominated site, the maximum number of acres that could be treated in one day with picloram at application rates of 0.50 and one pound per acre without exceeding the MATC value would be approximately 20 acres and 10 acres, respectively.

As an additional analysis, the maximum number of acres of spotted knapweed in the Hull Creek watershed that could be treated in one day using 2,4-D amine rather than picloram without exceeding the MATC value for 2,4-D (4 mg/L, Table 3-39) also was calculated. Application rates of 1 and 2 pounds of 2,4-D per acre were assessed. These calculations show that on a runoff-dominated site, the maximum number of acres that could be treated in one day with 2,4-D amine at application rates of 1 and 2 pounds per acre without exceeding the MATC value, which is considered protective of aquatic life, would be approximately 38 acres and 19 acres, respectively. On an infiltration-dominated site, the maximum number of acres that could be treated in one day with 2,4-D amine at application rates of 1 and 2 pounds per acre without exceeding the MATC value would be approximately 380 acres and 190 acres, respectively.

Challis Creek Watershed, Eddy Creek (HUC 170602011603):

Eddy Creek has a seasonal low flow of 2.51 cfs and drains 13,492 acres. A total of 132 acres of spotted knapweed, 5 acres of musk thistle, and 5 acres of leafy spurge have been inventoried in the Challis Creek HUC 5 that contains the Eddy Creek drainage. Volcanic soils, which are among the less permeable soils in the SCNF, comprise 90 percent of the soil types in the Challis Creek HUC 5. The same type of analysis of picloram and 2,4-D amine as described above for Hull Creek was conducted for Eddy Creek, using a seasonal low streamflow of 2.51 cfs. Calculations for picloram show that on a runoff-dominated site in the Eddy Creek watershed, the maximum number of acres that could be treated in one day with picloram at application rates of 0.50 and 1 pound per acre without exceeding the MATC value of 0.12 mg/L would be approximately 8 acres and 4 acres, respectively. On an infiltration dominated site, the maximum number of acres that could be treated in one day with picloram at application rates of 0.50 and 1 pound per acre without exceeding the MATC value would be approximately 80 acres and 40 acres, respectively.

Calculations for 2,4-D amine show that on a runoff-dominated site, the maximum number of acres that could be treated in one day with 2,4-D amine at application rates of 1 and 2 pounds per acre without exceeding the MATC value of 4 mg/L would be approximately 135 acres and 67 acres, respectively. On an infiltration-dominated site in the Eddy Creek drainage, the maximum number of acres that could be treated in one day with 2,4-D amine at application rates of 1 and 2 pounds per acre without exceeding the MATC value would be approximately 1,350 acres and 670 acres, respectively. These data suggest that, if desired and depending on site characteristics, a combination of picloram and 2,4-D amine could be applied at appropriate rates in a single day to treat all of the inventoried invasive plant infestations in the Challis Creek HUC 5 without adversely impacting aquatic resources.

Upper Lemhi Watershed, Little Eightmile Creek (HUC 170602040504):

Little Eightmile Creek has a flow of 1.13 cfs and drains 12,534 acres. A total of 197 acres of spotted knapweed, 53 acres of musk thistle, 37 acres of Canada thistle, and 3 acres of leafy spurge have been inventoried in the Middle Lemhi HUC 5 that contains the Little Eightmile Creek drainage. Quartzite is the predominant soil type (63 percent of the total) in the Upper Lemhi HUC 5, followed by lesser amounts of the less permeable volcanic (15 percent) and sedimentary (11 percent) soil types. The same type of analysis of picloram and 2,4-D amine as described above for Hull Creek and Eddy Creek was conducted for Little Eightmile Creek, using a seasonal low streamflow of 1.13 cfs. Calculations for picloram show that on a runoff-dominated site in the Little Eightmile Creek watershed, the maximum number of acres that could be treated in one day at application rates of 0.50 and 1 pound per acre without exceeding the MATC value of 0.12 mg/L would be approximately 4 acres and 2 acres, respectively. On an infiltration-dominated site, the maximum number of acres that could be treated in one day with picloram at application rates of 0.50 and 1 pound per acre without exceeding the MATC value would be approximately 40 acres and 20 acres, respectively.

Calculations for 2,4-D amine show that on a runoff-dominated site, the maximum number of acres that could be treated in one day at application rates of 1 and 2 pounds per acre without exceeding the MATC value of 4 mg/L would be approximately 60 acres and 30 acres, respectively. On an infiltration-dominated site in the Little Eightmile Creek drainage, the maximum number of acres that could be treated in one day with 2,4-D amine at application rates of 1 and 2 pounds per acre without exceeding the MATC value would be approximately 600 acres and 300 acres, respectively. These data suggest that if desired, and depending on site-specific characteristics determined during

the implementation process, a combination of picloram and 2,4-D amine could be applied at appropriate rates in a single day to treat all or most of the 290 acres of inventoried infestations in the Upper Lemhi watershed without adversely impacting aquatic resources.

Leaching Scenario

Herbicides can potentially move through soils with rainfall, depending on soil permeability and water-holding capacity. They can subsequently enter groundwater and surface water and potentially harm aquatic resources if their concentrations are high enough. If a soil is coarse and permeable, water can pass through the soil rapidly and carry some of the herbicide with it. If soils retain water in their upper horizons for later use by plants, there will be less opportunity for the water and herbicide to move through the soil and impact aquatic resources (USDA Forest Service 1999). The Forest Service (USDA Beaverhead-Deerlodge National Forest 2001) noted that a reduced potential for leaching is largely facilitated by plant uptake of the herbicide, natural decomposition, volatilization of active ingredients in the herbicide, and adsorption of the herbicide by soil particles.

In a review of forest chemicals, Norris et al. (1991) stated that the "leaching of chemicals through the soil profile is a process of major public concern, but it is the least likely to occur in forest environments." Norris et al. (1991) also noted that most chemicals are relatively immobile in soil and that intense leaching can move chemicals less than 1 inch to 3 feet in depth, but these distances are small in comparison to distances between proposed treated areas and streams.

The Forest Service (1999) cited studies by Watson et al. (1989) on the occurrence of picloram in coarse, permeable-soils, in western Montana following its application at a rate of one pound per acre. As noted previously, picloram is a relatively mobile, persistent, and toxic herbicide that can be used to treat spotted knapweed. Picloram concentrations in the upper 5 inches of soil in the western Montana studies ranged from 205 to 366 parts per billion (ppb). The maximum concentration measured at soil depths between 30 and 40 inches was 24 ppb. No picloram was measured in shallow groundwater wells (detection level = 0.5 ppb) (USDA Forest Service 1999). A detection level of 0.5 ppb is equivalent to a concentration of 0.0005 mg/L, which is approximately 240 times less than the MATC for picloram believed by the USFWS to be safe for populations of aquatic resources.

The Forest Service (1999) cited other studies that measured and compared soil concentrations of herbicides less persistent in the environment than picloram. Specific data on soil permeability characteristics were not cited by the Forest Service (1999). In those studies, Rice et al. (1992; cited in Forest Service 1999) found that clopyralid was never detected at soil depths greater than 10 inches, and after 30 days 2,4-D was never detected at soil depths greater than 2 inches. However, the application rates were not described.

In those same studies (USDA Forest Service 1999), picloram was detected at soil depths between 10 and 20 inches within 30 days following spraying at one pound per acre, but it was not detected (detection level = 10 ppb or 0.01 mg/L) at a soil depth greater than 10 inches 1 or 2 years after spraying (Rice et al. 1992; cited in USDA Forest Service1999). The Forest Service (USDA Forest Service 1999) concluded that there is relatively little risk of the deep leaching of picloram, clopyralid, or 2,4-D. Results were assumed to be similar for the herbicide dicamba, even though it was not tested, because its persistence and mobility are similar to those of 2,4-D and clopyralid. The Forest Service cited other studies showing there is little probability of carryover of 2,4-D or dicamba in soils

from one summer to the following spring because of their short half-lives, and thus limited opportunity for these herbicides to accumulate in the soil and migrate into groundwater. The soil types identified in the Forest Service studies are similar to those found in the SCNF and it is expected that the persistence and mobility study results of Rice et al. (1992; cited in USDA Forest Service 1999) would be similar within the SCNF project area.

Finally, the Forest Service (1999) stated that even if small amounts of any of the less persistent herbicides (i.e. 2,4-D and clopyralid) entered streams or larger rivers within the FC-RONR Wilderness, that the "dilution factor would render the herbicide concentrations to infinitesimal levels."

These conditions are equally applicable to the streams within the SCNF project area, given the similar soil types and particularly because of the project design criteria implemented to minimize chemical contamination during implementation of the Current Action. It is similarly expected that any concentrations of herbicides that may leach through soils and reach surface waters in the SCNF would not pose a risk to aquatic resources. It is anticipated that picloram application rates in the SCNF under the Current Action would not exceed approximately one pound per acre (the same as in the western Montana studies of coarse, permeable soils by Watson et al. (1989)), and would therefore not occur in soil concentrations great enough to subsequently adversely affect aquatic resources. As noted in the previous discussion on the surface runoff of herbicides, many of the invasive plant infestation sites in the SCNF, either because of the presence of invasive plants and their effects on runoff and/or the nature of constructed features invasive plants are often associated with, are likely runoff-dominated sites rather than infiltration-dominated sites. The likelihood of exposing, much less adversely affecting, aquatic resources to herbicides leached through soils are therefore very low.

Soil types vary across the SCNF and can influence the degree to which infestation site is runoff-dominated or infiltration-dominated. For example, soil types associated with locations assessed in the worst-case analyses indicate runoff-dominated conditions in the Upper Little Lost HUC 5 (Lost River Ranger District) and the Challis Creek HUC 5 (Challis Ranger District) and infiltration-dominated conditions in the Middle Lemhi HUC 5 (Leadore Ranger District) and the North Fork HUC 5 (North Fork Ranger District). On average, all soil types in the SCNF have moderate amounts of coarse fragments. Very generally, the predominant soil types by Ranger District tend to consist of the following: Challis Ranger District (volcanic, sedimentary, and quartzite); Leadore Ranger District (quartzite); Lost River Ranger District (sedimentary); Middle Fork Ranger District (volcanic and quartzite); North Fork Ranger District (quartzite and granitic); Salmon-Cobalt Ranger District (volcanic, quartzite, and granitic); and Yankee Fork Ranger District (volcanic, quartzite, and sedimentary). The predominance of quartzite soils, which are among the more permeable soil types, in the North Fork HUC 5 where the majority of invasive plants that have been inventoried in the SCNF occur illustrates the importance of considering local soil types before implementing large scale invasive plant treatments within a drainage.

Accidental Spill Scenario

The Forest Service (SERA 2004d) reports that most groundwater contamination by herbicides is derived from point source discharges, such as accidental spills, leaks, storage and handling facilities, improperly discarded containers, or rinsing equipment in loading and handling areas. These discharges can result in localized high concentrations of herbicides. The Forest Service (1999)

discussed results of two studies where picloram was intentionally introduced to streams. In the first study, 2.8 pounds of picloram were introduced to a stream flowing 190 cfs. Maximum picloram concentration 100 yards downstream from the introduction point 6 minutes later was 14 mg/L. Approximately 3.5 miles downstream, the maximum picloram concentration was 0.005 mg/L, which is less than the MATC (0.12 mg/L) and NOEL (0.29 mg/L) values for picloram. In a second study, a picloram concentrate of 6.26 mg/L was metered into a stream for 50 minutes. No picloram was detected (detection level = 0.001 mg/L) beyond about 4 miles downstream. The maximum picloram concentration upstream of this point (2.362 ppm, measured about 0.25 mile downstream of the introduction point) lasted approximately 1 hour. Based on these studies, the Forest Service (1999) observed that: 1) herbicide concentrations tend to drop rapidly within a short distance of the spill site, and 2) at any given point in the stream, the elapsed time of exposure to the spilled herbicide should be short.

A spill of the same amount of herbicide into a smaller flowing stream could result in initial concentrations that are higher than those observed in the above study. However, the LC50 values are based on 96 hours of continuous exposure, and it is likely that a spill would create exposure conditions that would last less than the 96 hours used to test the lethal concentration levels. Nonetheless, it is possible that exposure to herbicides, particularly picloram, might be sufficient to kill fishes or affect survival or behavior of aquatic organisms (Forest Service 1999). In the event of an herbicide spill, the potential for harming aquatic resources would depend on numerous factors that include an approved spill plan, the spill amount, herbicide toxicity, exposure duration, and receiving water flow.

To reduce the risk of this potential occurrence, a number of project design criteria have been identified for the ground-based application of herbicides (Appendix J).

Wind Drift Scenario

Herbicides can move through the atmosphere through spray drift, which occurs during herbicide application, and volatilization, which occurs after application. Spray drift is the movement of the herbicide, generally via spray droplets, from the target area to an unintended area. Spray drift is dependent on the sprayer parameters such as nozzle orifice size, boom height and pressure, and wind speed, while volatility is dependent on the physical properties of the herbicide, primarily vapor pressure (Branham and Hanson 1987). Table 3-10 identifies volatility potentials of herbicides utilized in the Current Action.

Risk of contamination during the ground-based application of herbicides is low because application occurs more slowly and applicators are able to recognize potential problems and adjust their application techniques (SERA 2004b). To reduce the risk of the potential for such impacts to occur, a number of project design criteria have been identified for ground-based application of herbicides under Alternative 2. Examples relevant to protection of aquatic environments include the following:

- See Appendix E regarding application of herbicides in proximity to water.
- Monitor wind speed and direction and equipment and spray parameters throughout an herbicide application.
- No herbicide shall be applied in sustained wind conditions exceeding five (5) miles per hour in riparian areas or in any wind conditions exceeding product label directions.

- To minimize herbicide drift during broadcast operations, use low pressure and larger droplet size to the extent possible with the equipment being used. Use nozzles designed for herbicide application.

The project design criteria are designed to minimize the potential for drift from ground-based herbicide application. The possibility of herbicides entering fish habitat as a result of drift is dependent on the implementation of these design criteria.

Adjuvants

The EPA reviews the inert ingredients prior to registration of herbicides. The lack of disclosure on the label of other ingredients in a formulation indicates that none of the inert ingredients present at a concentration of 0.1% or greater are classified as hazardous or toxic (SERA 2004a). The inclusion of certain ingredients in adjuvant formulations is regulated by the EPA, but the testing, the oversight of manufacture, and the use of adjuvants are not regulated consistently.

During the preparation of the SERA risk assessments for herbicides utilized under the SCNF's Current Action, data on inert ingredients that were in the confidential business information (CBI) files or obtained under a FOIA request was reviewed. The exception was for 2,4-D, whose study predates FOIA availability (USDA Forest Service 2006). The herbicide formulations that had proprietary information released included inert ingredients that are on the EPA Inert List 4A: minimal risk ingredients (low toxicity or non-toxic); List 4B: other ingredients for which EPA has sufficient information to reasonably conclude that the current use will not adversely affect public health; or List 3: inert ingredients for which available toxicology data are insufficient to classify the compound as of toxicologic concern (List 1), possible toxicologic concern (List 2), or of minimal concern (List 4). No toxic substances were identified as being included in herbicide formulations utilized under the SCNF's Current Action.

Effects of Alternative Implementation Relative to Worst Case Scenarios

Implementation of Alternative 2 is not expected to reach any of the potential levels of impact described under these worst-case scenarios. It is unlikely that any of the worst-case situations analyzed in the preceding text would occur under the Current Action due to the extensive design criteria associated with ground-based herbicide applications, coupled with an adaptive strategy. Design criteria for ground based herbicide treatment under this alternative would minimize potentials for chemicals to reach aquatic habitats via any of the identified routes, including surface runoff, leaching, wind drift or accidental spills. If worst-case conditions did occur, the scenarios involving herbicide runoff and leaching of herbicides would not be expected to result in adverse impacts on populations of aquatic resources. Potential short-term impacts on aquatic and riparian resources could occur, however, if there was an accidental spill of a relatively toxic herbicide in a small drainage. The scope and magnitude of resulting effects would be dependent on various factors, including the volume of spill and dilution by the receiving water. Adherence to project design criteria would reduce the likelihood of such a spill occurring, and would minimize or avoid the potential occurrence of wind-drift-related impacts on aquatic resources.

Beyond avoidance of worst case scenarios, design criteria of Alternative 2 would be expected to effectively minimize and avoid herbicide impacts to aquatic habitats and fisheries resources. Picloram was frequently selected to illustrate the worst-case scenario examples due to its higher general toxicity to fish species. The other nine chemicals currently utilized by the SCNF under the

Current Action all display lower toxicity to fish than Picloram, and are typically utilized at much lower application rates. Design criteria for herbicide applications under this alternative additionally consider chemical toxicities, application rates and aquatic use certifications in identifying relative herbicide toxicity risk quotients were used to delineate herbicide-specific application buffers to avoid impacts to fisheries resources (Table 2-4).

Effects to Federally-Threatened and Endangered and Forest Service Region 4 Sensitive Fish Species

Implementation of herbicide treatments under Alternative 2 are not considered likely to adversely affect Federally-listed species habitats occurring within the SCNF non-wilderness project area, including: Snake River spring/summer Chinook salmon, Snake River sockeye salmon, Snake River Basin steelhead, and Columbia River bull trout. Implementation is further considered not likely to adversely affect designated critical habitats for these species occurring within the project area.

Direct effects to Federally-Threatened and Endangered, and Forest Service Region 4 sensitive fish species as a result of exposure to herbicides used under the SCNF's Current Action are not likely to occur. Design criteria minimize potentials for herbicide entry to Forest waterway via surface runoff, wind drift, leaching, or direct spill pathways. With the exception of picloram, all herbicides utilized by the SCNF under Alternative 2 display low toxicity and risk values to salmonid fish species. Increased application buffers are specified for picloram in recognition of its higher toxicity and moderate risk classification.

Indirect effects to aquatic habitats, including designated critical habitats for Federally listed species, are expected to be minimal and limited to potential short term increases in sedimentation at sites where removal of invasive plants temporarily leaves areas of barren ground until re-vegetation with native plants occurs. No broadcast herbicide applications would occur in riparian areas, so impacts to native riparian vegetation integrity would be expected to be minimal.

Effects to Forest Service Region 4 sensitive westslope cutthroat trout are similar to those identified for Federally listed species. Implementation of the Current Action may impact individual westslope cutthroat trout, but the level and scope of impacts would not likely contribute to a trend towards Federal listing, or cause a loss of viability to the population or species or be expected to result in a downward trend for the species.

Effects to MIS Fish Species

Population trends for the SCNF's aquatic Management Indicator Species in the SCNF are discussed in the Affected Environment section of this document. Direct and indirect effects to bull trout are identified above. Effects of implementation of the Current Action are not expected to be of sufficient nature or magnitude to result in measureable influence on future trend of bull trout populations in the SCNF.

Summary of Direct and Indirect Effects

Under the Current Action, invasive species infestations within the project area are expected to continue to spread, but the percent of annual expansion of invasive species would be less than under the No Action alternative. However, the current management strategy is not likely to be able to effectively treat large, more remote infestations using the currently approved methods. Because

treatments under the Current Action would limit the spread of some new infestations and potentially decrease the severity of some existing infestations, the effects described above would be less severe and would occur over a longer time frame than those described under the No Action alternative

Design criteria related to ground based herbicide application under this alternative are expected to effectively protect SCNF fisheries resources, including Federally-Threatened and Endangered, Regionally-sensitive, and SCNF MIS fish species, from impacts due to herbicide delivery to aquatic habitats. Design Criteria identified for ground based herbicide applications under Alternative 2 would minimize the potential for both direct delivery of herbicides to aquatic habitats, or impacts to those habitats as a result of surface runoff, wind drift, leaching, or accidental spills. However, short term disturbances may occur and may have a slight negative effect on aquatic resources in specific areas. These impacts could include localized short-term increases in erosion and sediment delivery to drainages caused by creation of barren ground (from invasive plant removal). Long term benefits to aquatic habitats from slowing potential rates of spread would be expected to be greatest in the northern part of the SCNF where infestations are extensive.

3.4.6.4. Alternative 3-Proposed Action

The proposed action is designed to supplement the current SCNF program to more effectively prevent the establishment of new invasive plant species, prevent further spread of existing invasive plants, and maintain native plant communities. Like the Current Action, the Proposed Action would continue to implement an adaptive integrated weed management (IWM) strategy to eradicate or control existing or newly discovered invasive plants over the next ten to fifteen years as Forest budgets allow. The IWM strategy is derived from Forest Service Manual direction (FSM 2900) and through national and regional strategic frameworks and management plans (USDA Forest Service 2013; USDA Forest Service R4 2014).

As with the Current Action, continued application of the adaptive IWM program under the Proposed Action would utilize a variety of tools, used alone or in combination, to treat invasive plants in the SCNF. Control could often require repeat treatments and monitoring of control efficacy. Invasive plant treatment methods that could be implemented under the Proposed Action include ground based and aerial herbicide application treatments of terrestrial infestations, mechanical treatments, biological control releases, cultural methods, and combinations of these treatments. Ground based herbicide treatments would incorporate the use of three additional chemicals (aminopyralid, imazapyr, imazamox) in addition to the ten currently-authorized herbicides utilized under the Current Action. Aerial treatments under the Proposed Action would utilize six of the herbicides currently authorized for ground based applications (chlorsulfuron, clopyralid, imazapic, metsulfuron-methyl, picloram, sulfometuron-methyl), and would add aminopyralid. Aquatic infestations would be treated with glyphosate, imazapyr, imazamox or triclopyr TEA.

Alternative 3 would additionally implement a strategy to rapidly respond to new infestations of aquatic invasive plant species though herbicide and/or mechanical treatments.

Herbicide Treatments

The Proposed Action includes ground-based and aerial herbicide application methods to treat up to 16,000 acres of terrestrial invasive plant infestations annually. In addition to the ten herbicides

currently utilized under the SCNF's Current Action, the Proposed Action includes an additional three herbicides – aminopyralid, imazapyr and imazamox for potential use in treatments. Alternative 3 additionally includes the option for aerial application of herbicides to treat larger infestations of terrestrial invasive plants. Aerial applications could utilize seven of the nine herbicides utilized for ground based terrestrial invasive plant treatments – aminopyralid, chlorsulfuron, clopyralid, imazapic, metsulfuron-methyl, picloram, and sulfometuron-methyl. The Proposed Action also implements a new aquatic invasive plant treatment strategy, with potential use of the additional herbicides imazapyr and imazamox, along with the currently terrestrially-used triclopyr, to treat new aquatic invasive plant infestations.

Additional Herbicides

Aminopyralid is a low toxicity, low application rate herbicide belonging to the same class of herbicides as picloram and clopyralid. Aminopyralid is already in use in the FC-RONR Wilderness, and is proposed for use in the SCNF non-wilderness project area based upon its demonstrated control of spotted knapweed and rush skeletonweed. Because of its low toxicity and environmental fate profile (SERA 2007), aminopyralid can be used in riparian areas and close to water, where picloram and clopyralid cannot be used.

Aminopyralid displays a low toxicity to both fish and aquatic invertebrates. Acute 96 hr. LC50, MATC and NOEC values from bioassays on rainbow trout are identified in Table 3-40. The EPA classifies aminopyralid as "practically non-toxic to freshwater fish", and "practically non-toxic to freshwater invertebrates" (SERA 2007). Consideration of maximum application rate expected environmental concentration (EEC) in relation to toxicity identifies aminopyralid as a "low risk" herbicide (Table 2-4).

Imazapyr is a broad spectrum herbicide that is similar to glyphosate in terms of its non-selectivity.

Imazapyr is labeled for aquatic applications (SERA 2011) and is recognized as being an effective herbicide for an array of emergent aquatic invasive plants and invasive plant species that grow right along the water's edge, often with their roots in the water (Tu et al. 2001), such as salt cedar and knotweeds. SCNF use of imazapyr would be for aquatic applications and waterline applications made to invasive plant species that grow with their roots in the water.

Imazapyr displays a low toxicity to both fish and aquatic invertebrates. Acute 96 hr. LC50, MATC and NOEC values from bioassays on rainbow trout are identified in Table 3-40. The EPA classifies imazapyr as "practically non-toxic to fish", and "practically non-toxic to Daphnia" (SERA 2011). Consideration of maximum application rate expected environmental concentration (EEC) in relation to toxicity identifies imazapyr as a" low risk" herbicide (Table 2-4).

In aquatic settings, imazapyr has little or no toxicity to submerged aquatic plants (BASF 2012). It must be applied to emergent vegetation. Native macrophytes that grow submerged in water would not be affected by imazapyr. Native macrophytes that grow emerged from the water, however, could be affected by imazapyr applications made to non-native invasive aquatic plants.

Imazamox is labeled for aquatic applications (SERA 2010), and is active on submerged, emergent and floating monocot aquatic plants (BASF 2009). The SCNF proposes to use imazamox only in aquatic settings for eradication of aquatic invasive plants (i.e. Brazilian elodea, hydrilla, and invasive

water milfoils) in water bodies and at the water's edge. The efficacy and selectivity of imazamox on aquatic vegetation is determined by the use rate and by the method of application.

Imazamox displays a low toxicity to both fish and aquatic invertebrates. Acute 96 hr. LC50, MATC and NOEC values from bioassays on rainbow trout are identified in Table 3-40. Imazamox is characterized in its Risk Assessment (SERA 2010) as "essentially non-toxic to fish". Toxicity to freshwater invertebrate species is considered similar to that to fish (ibid). Consideration of maximum application rate expected environmental concentration (EEC) in relation to toxicity identifies imazamox as a "low risk" herbicide (Table 2-4).

Like imazapyr, native macrophytes could be injured or killed by imazamox, if present and growing interspersed with target aquatic invasive plants (SERA 2010).

Table 3-40 supplements information identified for herbicides utilized under the Current Action (Table 3-39), including LC_{50}, MATC and NOEL concentrations, to include the additional three herbicides proposed for use under the Proposed Action – aminopyralid, imazapyr and imazamox. Toxicity levels are presented for four different categories. The 96-hour LC_{50} level is that concentration of herbicide that is lethal to 50 percent of the test organisms (primarily rainbow trout in the examples) exposed to that concentration for 96 hours. The lower the LC_{50} value, the more toxic the herbicide. While the 96-hour LC_{50} value provides a standard for comparing toxicities among herbicides, it is generally considered an unacceptable level of impact or risk to fish populations.

Table 3-40: LC_{50}, MATC, and NOEL/NOEC Concentrations of Herbicides Used by the Salmon-Challis National Forest (Alternative 3) SCNF

Herbicide (Test Species)	96-Hour LC_{50} (mg/L)	LC50/10 (mg/L)	MATC (mg/L)	NOEL/NOEC (mg/L)
2,4-D Amine	420	42	4	10 NOEL
Aminopyralid	>100	>10	>4	100 NOEC
Chlorsulfuron	250	25	46	32 NOEC
Clopyralid	103	10.3	44	23 NOEL
Dicamba	28	2.8	1.12	56 NOEL
Glyphosate	140	14	0.04	1 NOEL
Imazamox	>122	>12.2	>4.9	122 NOEC
Imazapic	>100	>10	>4	100 NOEC
Imazapyr	>100	>10	>4	-
Metsulfuron-methyl	>150	>15	>6	100 NOAEL
Picloram	3.5	0.35	0.12	0.29 NOEL
Sulfometuron methyl	>148	>14.8	5.9	>148 NOEL
Triclopyr: triethylamine salt (TEA)	420	42	6	-

[1]MATC: Maximum Acceptable Toxicant Concentration
[2]No Observed Effect Level
[3]No Observed Effect Concentration
[4]No Observed Adverse Effect Level
2,4-D Amine: 96hr LC_{50} and MATC from Mayer and Ellersieck (1986); NOEL from SERA (2001)
Aminopyralid: 96hr LC_{50} and NOEL from Marino et al (2001) in SERA (2007); MATC = LC_{50}/25 per Mayer and Ellersieck (1986)
Chlorsulfuron: 96hr LC_{50} from Smith (1979) in SERA (2004); MATC and NOEC for RBT fingerlings from Pierson (1991) in SERA (2004)
Clopyralid: 96hr LC_{50} and NOEL from SERA (1999); MATC from Mayer and Ellersieck (1986)
Dicamba: 96hr LC_{50} and MATC from Mayer and Ellersieck (1986); NOEL from McAllister et al (1985) in SERA (2004)
Glyphosate: 96hr LC_{50} and NOEL from SERA (1996); MATC from Mayer and Ellersieck (1986)
Imazamox: 96hr LC_{50} and NOEC from Yurk and Wisk (1994) in SERA (2010); MATC = LC_{50}/25 per Mayer and Ellersieck (1986)
Imazapic: 96hr LC_{50} and NOEC from SERA (2004); MATC = LC_{50}/25 per Mayer and Ellersieck (1986);
Imazapyr: 96hr LC_{50} from US EPA (2005, 2007) in SERA (2011); MATC = LC_{50}/25 per Mayer and Ellersieck (1986); No NOEL value identified.
Metsulfuron-methyl: 96hr LC_{50} and NOAEL from Muska and Hall (1982) in SERA (2004); MATC = LC_{50}/25 per Mayer and Ellersieck (1986)
Picloram: 96hr LC_{50} and NOEL from Woodward (1976,1979);MATC from Mayer and Ellersieck (1986)
Sulfometuron-methyl: 96hr LC_{50} and NOEL from Brown (1994) in SERA (2004); MATC = LC_{50}/25 per Mayer and Ellersieck (1986)
Triclopyr TEA: 96hr LC_{50} from Wan et al (1987) in SERA (2011); MATC = LC_{50}/25 per Mayer and Ellersieck (1986); No NOEL value identified.

Two other sets of values or criteria listed in Table 3-40 are believed by researchers to protect aquatic organisms. In the first set of criteria, the EPA (EPA 1986) recommends that the 96-hour LC_{50} value be divided by 10 to set a standard for herbicide concentrations that will protect aquatic organisms (USDA Forest Service 1999; USDA Panhandle National Forest 2001). In the second set of criteria developed by the USFWS (Mayer and Ellersieck 1986), the maximum acceptable toxicant concentration (MATC) represents the acute toxicity value of either rainbow trout or *Daphnia* spp. (a type of water flea), whichever is less, to a specific herbicide divided by 25. The USFWS believes that if herbicide concentrations are equal to or less than the MATC, then all aquatic species will be

reasonably protected; certain individuals may still react to the herbicide but the overall population is considered safe (Mayer and Ellersieck 1986). The MATC method is comparable to methods used in risk assessments conducted by the Forest Service and complies with directions outlined in the Forest Service Handbook (1995).

The LC_{50} divided by 10 values and the MATC values listed in Table 3-40 are used as criteria in the following assessment to determine the potential for herbicide-related impacts on aquatic organisms in the SCNF. Both methods have been used in recent NEPA invasive plant management assessment documents prepared by the Forest Service. The LC_{50} divided by 10 criteria were used for the FC-RONR Wilderness in central Idaho (USDA Forest Service 1999) and the Sandpoint Ranger District in northern Idaho (USDA Panhandle National Forest 2001). The MATC criteria were used for the Beaverhead-Deerlodge National Forest (2001) and the Flathead National Forest (USDA Flathead National Forest 2000) in western Montana. Projected values are also compared against NOEL values in the following assessment. NOEL values usually exceed calculated MATC values.

As with those herbicides authorized under the Current Action, the additional three herbicides proposed for use in the SCNF under Alternative 3 may also contain “inert” ingredients, including surfactants, which are not expected to have any significant effect. The dyes and other adjuvants identified in Appendix D are described as having little effect on fish or wildlife populations. As under the Current Action, project design criteria for herbicide applications under the Proposed Action are expected to minimize adverse impacts, if any, of these other ingredients.

Direct and Indirect Effects

Direct and Indirect Effects of Ground-Based and Aerial Terrestrial Invasive Plant Treatments

Mechanisms of potential entry of herbicides to aquatic ecosystems during ground or aerial treatment of terrestrial invasive plants include surface runoff, leaching through soils, accidental spills, and wind drift. The potential impact of an herbicide on aquatic organisms depends on the toxicity characteristics and exposure concentration of that herbicide.

The following examples illustrate the effectiveness of design criteria and BMPs in the aerial and ground-based application of herbicides to safely and effectively treat noxious weeds in the western United States. For the Mormon Ridge Winter Range Restoration Project on the Lolo National Forest in western Montana, picloram was applied aerially in 1997 to treat noxious weeds on approximately 900 acres (TechLine 1998). This site provides important winter range for elk and deer because of the presence of large bunchgrass, but it had deteriorated due to spotted knapweed and leafy spurge infestations. Picloram was applied aerially at a rate of 1.5 pints per acre (approximately 0.37 pound per acre) using the same types of design criteria and BMPs that would be employed in aerial herbicide applications in the SCNF, including a 300-foot no-treatment buffer to keep herbicides out of all fish-bearing water bodies. Water samples were collected from Mormon Creek prior to, during, 30 minutes after, and 60 minutes after aerial herbicide application (TechLine 1998). Water samples were tested for picloram at a detection level down to 0.01 part per billion (0.01 microgram per liter), which is far below any levels of toxicological significance. Picloram was not detected in any of the water samples, indicating the stream protection measures were effective.

As discussed previously under the Current Action alternative, results of water monitoring studies in association with herbicide applications in Region 5 of the Forest Service illustrate the effectiveness

of BMPs and buffers when properly implemented (Bakke 2001). Of 140 surface water samples collected on these Forests during reforestation and invasive plant eradication projects using ground-based applications of glyphosate and triclopyr, there were no detections of glyphosate in any samples taken after reforestation projects that were not ascribed to contamination. The one project with a detection of glyphosate involved treatment of invasive plant within the riparian zone. Even here, only one of twelve samples had a detection of glyphosate and that was at a low level of 15 micrograms per liter, which is below any level of concern for human health or aquatic resources (Bakke 2001). The few positive detections of triclopyr in non-accidental or erroneous applications in water monitoring were all at levels below any aquatic Levels of Concern (highest 2.4 micrograms per liter). The highest level of triclopyr detected (82 micrograms per liter) was the result of an absence of a no-treatment buffer on an ephemeral stream, and even this level did not represent a substantial risk of harm to humans or the environment (Bakke 2001).

To estimate the risk of possible herbicide concentration in streams, it is important to distinguish whether rainfall on an invasive plant treatment site is infiltration-dominated or runoff dominated. Rainfall typically percolates into the soil on an infiltration-dominated site, but it is more likely to produce overland flow on a runoff-dominated site. Vegetative cover, soil type, degree of surface disturbance and compaction, and land slope determine whether rainfall infiltrates or runs off a site (USDA Panhandle National Forest 2001, USDA Beaverhead-Deerlodge National Forest 2001, USDA Lolo National Forest 2001, USDA Forest Service 1999). Undisturbed forests and grasslands in the SCNF are typically associated with infiltration-dominated sites. The overland transport of herbicides applied to smaller infestations occurring on this type of landscape would be expected to be minimal. However, many of the infestations in the SCNF are associated with roads, trails, paths, and other areas where the soil has been disturbed and/or compacted. Road prisms, road cuts, and road fills are runoff-dominated features. They enhance runoff by concentrating flows on compacted road surfaces and in ditches, and in some cases by intercepting groundwater flow from cut slopes (USDA Panhandle National Forest 2001, USDA Beaverhead-Deerlodge National Forest 2001, USDA Lolo National Forest 2001). Compacted, coarse-sized material with low organic matter that is used to create road fill slopes can also contribute to increased runoff. In addition, the Forest Service (USDA Forest Service 1999, USDA Panhandle National Forest 2001, USDA Beaverhead-Deerlodge National Forest 2001, USDA Lolo National Forest 2001) noted that, in general, invasive plant infested areas could increase overland runoff, citing studies by Lacey et al. (1989) who reported a 50 percent increase in runoff at a knapweed-infested site compared to a non-infested site. In these settings in the SCNF, the potential for the inadvertent introduction of herbicides to streams would be expected to occur primarily via surface runoff.

Worst-Case Scenarios

The Proposed Action identifies six herbicides that can be used to treat spotted knapweed. They include 2,4-D amine, clopyralid, glyphosate, picloram and triclopyr, all currently utilized under the Current Action alternative, and an additional herbicide under the Proposed Action, aminopyralid. As under Alternative 2, the range of toxicities of these herbicides provides a broad representation of possible adverse effects if herbicides inadvertently enter aquatic ecosystems. Among these herbicides, Picloram represents potentially worst-case conditions for aquatic organisms both because of its higher toxicity to fish, and its persistence and mobility in the environment compared to the other herbicides.

Four worst-case situations involving the use of herbicides in the SCNF are analyzed in the following text. They include the inadvertent entry of herbicides into aquatic ecosystems through surface

runoff, leaching through soils, accidental spills, and wind drift. While scenarios identified under the Alternative 2 analysis were limited to ground based herbicide applications, scenarios identified for Alternative 3 include aerial application examples. These four situations are generally regarded as worst-case examples because of the extensive list of project design criteria that would be implemented as integral parts of the Proposed Action to avoid or minimize the potential for worst-case adverse effects to occur. For example, BMPs and design criteria are included to avoid or minimize the possibility of extreme rain events occurring after herbicide spraying, since such an occurrence could cause a runoff event. In addition, use of a collaborative site-specific implementation process for larger scale invasive plant treatments would avoid the occurrence of worst-case conditions. These site-specific processes are designed to avoid or minimize the potential for adversely affecting SCNF resources, especially sensitive aquatic resources.

Surface Runoff Scenarios

Six worst-case scenarios involving surface runoff and the inadvertent entry of herbicides used to treat invasive plants into drainages are analyzed in the following text. Two of these analyses assume that herbicides are used to treat spotted knapweed in the North Fork HUC 5 of the North Invasive Plant Management Zone. Inventoried infestations of spotted knapweed within the North Invasive Plant Management Zone total approximately 21,500 acres and are by far the worst infestations in the SCNF. The first analysis examines the ground-based application of picloram, re-identifying the ground application scenario analyzed previously under the Current Action alternative. The second analysis examines an aerial application of picloram, reflecting the addition of this potential treatment method under the Proposed Action alternative This second analysis additionally identifies the same scenario utilizing aminopyralid as a lower toxicity alternative herbicide in place of picloram. The third worst-case scenario examines the ground-based application of 2,4-D amine to treat spotted knapweed and Canada thistle in the Lost River Drainage of the Pahsimeroi-Lost Invasive Plant Management Zone, and like the first scenario, reflects worst case scenarios under the ground based treatment methods identified for both the Current Action and Proposed Action alternatives. The final three worst-case scenarios are presented under the heading Low Flow Watersheds. These analyses examine the effects of herbicide treatments on three comparatively small drainages associated with 6th order HUCs in the North Invasive Plant Management Zone (Hull Creek), the Upper Salmon Invasive Plant Management Zone (Eddy Creek), and the Lemhi Invasive Plant Management Zone (Little Eightmile Creek), and re-identify worst case scenarios described for ground based applications common to both the Current Action and Proposed Action alternatives.

Picloram—North Zone, North Fork Watershed (HUC 1706020306), Ground Application:

See analysis under Alternative 2.

Picloram—North Zone, North Fork Watershed (HUC 1706020306) Aerial Application:

This worst-case analysis involves the aerial application of to treat 500 acres of spotted knapweed in one day during summer. This analysis is believed to represent a worst-case scenario because of the very large acreage that would be treated in a single day, together with the assumption that a maximum of 10 percent of the applied herbicide on a runoff-dominated site would enter a stream via surface runoff over a 6-hour period. At an application rate of 0.5 pound of picloram per acre, a total of 250 pounds of picloram would be applied to the 500-acre treatment site in one day. This analysis assumes that 10 percent (25 pounds) of the applied picloram runs off and enters the North Fork Salmon River over a 6-hour period in October when the average flow of the North Fork is 14 cfs

(USDA Salmon-Challis NF 1998). The resultant average concentration of picloram in the North Fork would be 1.35 mg/L. This value is approximately 3.9 times the greater than the LC50 divided by 10 value (0.35 mg/L), 4.7 times the NOEL value (0.29mg/L) and 11.3 times the MATC value (0.12 mg/L) for picloram. At this level of treatment utilizing picloram, populations of aquatic resources would not be considered safe in the event such a worst-case scenario occurred.

Using these same assumptions and the maximum picloram label application rate of 1 pounds (rather than 0.5 pound) per acre on runoff-dominated sites, the resultant average concentration of picloram in the North Fork Salmon River in October during a 6-hour rainfall event would be approximately 2.7 mg/L. This value is 7.7 times greater than the LC50 divided by 10 value (0.35 mg/L), 9.3 times greater than the NOEL value (0.29 mg/L), and approximately 22.5 times the MATC value (0.12 mg/L) (Table 3-40).

On infiltration-dominated sites where no more than one percent of the picloram applied could potentially enter a stream via surface runoff, the resultant average concentration in the North Fork Salmon River in October would be approximately one-tenth what it would be if herbicide input was from runoff-dominated sites. One these sites, resultant concentrations of picloram would be 0.135 mg/L when applied at a rate of 0.5 pound per acre and 0.27 mg/L when applied at a rate of 1 pound per acre. This concentration is less than the LC50 divided by 10 value (0.35 mg/L), and the NOEL value (0.29 mg/L) but just slightly exceeds the MATC value (0.12 mg/L) for picloram. These values should not represent a risk to aquatic resources. As noted previously, the more permeable quartzite soil type is predominant in this watershed.

Utilizing aminopyralid as an example of a low-use-rate herbicide proposed for aerial application on the Salmon-Challis National Forest, application of the herbicide at the high range of its proposed typical rate of 0.11 pounds per acre (also its maximum application rate) would deliver 55 pounds of aminopyralid to the 500-acre treatment site. Again assuming that 10 percent of the applied herbicide inadvertently runs off into a nearby runoff-dominated drainage from a rainstorm immediately after application, that stream would receive 5.5 pounds of aminopyralid over a 6-hour period. If 5.5 pounds of aminopyralid entered the North Fork Salmon River flowing at 14 cfs over a 6-hour period in October, the resultant concentration would be 0.29 milligram of aminopyralid per liter of river water (0.29 mg/L). This value is significantly less than both the LC50 divided by 10 (>10 mg/L) and the no-observed-effect levels (NOEL) (50 mg/L) for aminopyralid (SERA, 2007). This same application within an infiltration dominated drainage would yield a resultant aminopyralid concentration of 0.029 mg/L, even more significantly below picloram's LC50/10, NOEL and MATC value for protection of aquatic resources.

2,4-D amine—Pahsimeroi-Lost Zone, Upper Little Lost Watershed (HUC 1704021705):

See analysis under Alternative 2.

Low Flow Watersheds

North Zone, North Fork Watershed, Hull Creek (HUC 1706020300606):

See analysis under Alternative 2.

Upper Salmon Zone, Challis Creek Watershed, Eddy Creek (HUC 170602011603):

See analysis under Alternative 2.

Lemhi Zone, Upper Lemhi Watershed, Little Eightmile Creek (HUC 170602040504):

See analysis under Alternative 2.

Leaching Scenario

See analysis under Alternative 2.

Accidental Spill Scenario

See scenario under Alternative 2. To reduce the risk of this potential occurrence, a number of project design criteria have been identified for both the ground-based and aerial application of herbicides (Appendix J).

Wind Drift scenario

Herbicides can move through the atmosphere through spray drift, which occurs during herbicide application, and volatilization, which occurs after application.

Spray drift is the movement of the herbicide, generally via spray droplets, from the target area to an unintended area. Spray drift is dependent on the sprayer parameters such as nozzle orifice size, boom height and pressure, and wind speed, while volatility is dependent on the physical properties of the herbicide, primarily vapor pressure (Branham and Hanson 1987). Table 3-10 identifies volatility potentials of herbicides in the SCNF's Proposed Action program.

Aerial spraying near aquatic and riparian zones may represent the greatest potential of exposure of aquatic organisms to contaminants either through direct application or wind drift. Risk of contamination during the ground-based application of herbicides is less than during aerial application because application occurs more slowly and applicators are able to recognize potential problems and adjust their application techniques (SERA 2004d).

Spray drift cannot be completely eliminated; however, with proper management, drift levels can be minimized to levels that do not cause harm (Felsot 2001). To reduce the risk of the potential for such impacts to occur, a number of project design criteria have been identified for both the ground-based and aerial application of herbicides under Alternative 3 (Appendix J).

Rashin and Graber (1993) examined both the effectiveness and ineffectiveness of BMPs associated with aerial spraying of herbicides within the state of Washington. They concluded with several most important factors that influence the effectiveness of the BMPs and are as follows:

- Proximity of spray swaths to the streams (i.e., buffer widths)
- Streamflow regimes as they relate to the dilution of the chemicals
- Equipment configuration and operation and the resultant droplet size
- Ability of the operator to identify surface flow in streams
- Weather conditions that include wind speed, direction, and precipitation
- Pesticide toxicity and environmental characteristics

The project design criteria are designed to minimize the potential for drift from both ground-based and aerial application. The possibility of herbicides entering fish habitat as a result of drift is dependent on the implementation of these design criteria.

Adjuvants

See analysis under Alternative 2.

Effects of Alternative Implementation Relative to Worst Case Scenarios

As identified for Alternative 2, Implementation of Alternative 3 is not expected to reach any of the potential levels of impact described under these worst case scenarios. It is unlikely that any of the worst-case situations analyzed in the preceding text would occur under the Proposed Action due to the extensive design criteria associated with ground based herbicide applications, coupled with a site-specific collaborative implementation process, and an adaptive strategy. Design criteria for both ground based and aerial herbicides treatment under this alternative would minimize potentials for chemicals to reach aquatic habitats via any of the identified routes, including surface runoff, leaching, wind drift or accidental spills. If worst-case conditions did occur, the scenarios involving herbicide runoff and leaching of herbicides would not be expected to result in adverse impacts on populations of aquatic resources. Potential short-term impacts on aquatic and riparian resources could occur, however, if there was an accidental spill of a relatively toxic herbicide in a small drainage. The scope and magnitude of resulting effects would be dependent on various factors, including the volume of spill and dilution by the receiving water. Adherence to project design criteria would reduce the likelihood of such a spill occurring, and would minimize or avoid the potential occurrence of wind-drift-related impacts on aquatic resources.

Beyond avoidance of worst case scenarios, design criteria of Alternative 3 would be expected to effectively minimize and avoid herbicide impacts to aquatic habitats and fisheries resources. Picloram was frequently selected to illustrate the worst-case scenario examples due to its higher general toxicity to fish species. The other nine chemicals currently utilized by the SCNF under the Current Action alternative all display lower toxicity to fish than picloram, and are typically utilized at much lower application rates. Design criteria for herbicide applications under this alternative additionally consider chemical toxicity, application rates and aquatic use certifications in identifying relative herbicide toxicity risk quotients were used to delineate herbicide-specific application buffers to avoid impacts to fisheries resources (Table 2-4). The current 50 foot buffer for picloram ground applications specified under Alternative 2 would continue to be implemented under the Proposed Action alternative.

Effects of Ground-Based and Aerial Terrestrial Invaisve Plant Treatments to Federally-Threateneded and Endangered and Forest Service Region 4 Sensitive Fish Species

Implementation of ground based and aerial herbicide treatments proposed under Alternative 3 are not considered likely to adversely affect Federally-listed species occurring within the SCNF non-wilderness project area, including: Snake River spring/summer Chinook salmon, Snake River sockeye salmon, Snake River Basin steelhead, and Columbia River bull trout. Implementation is further considered not likely to adversely affect designated critical habitats for these species occurring within the project area.

Direct effects to Federally-Threatened and Endangered, and Forest Service Region 4 sensitive fish species as a result of exposure to herbicides used under the SCNF's Proposed Action program are not likely to occur. Design criteria minimize potentials for herbicide entry to Forest waterway via surface runoff, wind drift, leaching, or direct spill pathways. As with Alternative 2, all herbicides utilized by the SCNF under Alternative 3 with the exception of picloram display low toxicity and risk

values to salmonid fish species. Increased application buffers are specified for picloram in recognition of its higher toxicity and moderate risk classification.

Indirect effects to aquatic habitats, including designated critical habitats for Federally-listed species, are expected to be minimal and limited to potential short-term increases in sedimentation at sites where removal of invasive plant species temporarily leaves areas of barren ground until re-vegetation with native plants occurs. No broadcast herbicide applications would occur in riparian areas, so impacts to native riparian vegetation integrity would be expected to be minimal.

Effects to Forest Service Region 4 Sensitive westslope cutthroat trout are similar to those identified for Federally-listed species. Implementation of the Proposed Action program m ay impact individual westslope cutthroat trout, but the level and scope of impacts would not likely contribute to a trend towards Federal-listing, or cause a loss of viability to the population or species or be expected to result in a downward trend for the species.

Effects of Ground-Based and Aerial Terrestrial Invasive Plant Treatments to MIS Fish Species

Population trends for the SCNF's aquatic Management Indicator Species in the SCNF are discussed in the Affected Environment section of this document. Direct and indirect effects to bull trout are identified within the preceding TES species discussion above. Effects of implementation of the Proposed Action's ground based and aerial terrestrial invasive plant treatments are not expected to be of sufficient nature or magnitude to result in measureable influence on the past or future trend of bull trout populations in the SCNF.

Summary of Direct and Indirect Effects of Ground Based and Aerial Terrestrial Invasive Plant Treatments

As with the Current Action, long-term direct and indirect effects of invasive plant treatment under the Proposed Action would be expected to result in improved habitat conditions and reduced threats for aquatic and riparian resources on the SCNF. Invasive plant infestations would progressively decline at an expected rate greater than that under Alternative 2, due to the more aggressive treatment strategy and broad scale treatment opportunities afforded by aerial applications. Resultant benefits to aquatic resources through reduced erosion and sediment delivery to drainages would additionally occur at a faster rate than that under the Current Action alternative. Long-term broad scale benefits to aquatic habitats would be expected to be greatest in the northern part of the SCNF where infestations are extensive.

Design criteria identified for ground based and aerial herbicide applications under Alternative 3 would minimize the potential for both direct delivery of herbicides to aquatic habitats, or impacts to those habitats as a result of surface runoff, wind drift, leaching, or accidental spills. As with the Current Action alternative, however, short term disturbances may occur and may have a slight negative short term effect on aquatic resources in specific areas. These impacts could include localized short-term increases in erosion and sediment delivery to drainages caused by more extensive mechanical treatments (soil disturbance) and chemical treatments (creation of barren ground from invasive plant removal).

With implementation of Alternative 3-specific design criteria, it is unlikely that any of the ground or aerial application worst-case situations analyzed in the preceding text would occur. If worst-case

conditions did occur, the scenarios involving herbicide runoff and leaching of herbicides would not be expected to result in adverse impacts on populations of aquatic resources. Potential short-term impacts on aquatic and riparian resources could occur if there was an accidental spill of a relatively toxic herbicide in a small drainage. The scope and magnitude of resulting effects would be dependent on various factors, including the volume of spill and dilution by the receiving water. Adherence to project design criteria would reduce the likelihood of such a spill occurring, and would minimize or avoid the potential occurrence of wind-drift-related impacts on aquatic resources.

Direct and Indirect Effects of Aquatic Invasive Plant Treatments

Proposed SCNF chemical treatments under a newly developed aquatic invasive plant treatment strategy would utilize four herbicides certified for aquatic use and selected for their efficacy in controlling aquatic macrophytes while exhibiting low toxicity to fish, aquatic invertebrates, and non-target native aquatic grasses or algae. US Forest Service risk assessments for these herbicides identify the following conclusions regarding risk to aquatic organisms:

- Over the range of 2,4-D acid/salt application rates (including amine formulations of 2,4-D) used in Forest Service programs(0.5 to 4 lb/acre) adverse effects on fish, amphibians are aquatic invertebrates are likely only in the event of an accidental spill (USDA Forest Service 2006).
- Imazapyr and imazamox are identified as being “practically non-toxic to fish” and “practically non-toxic to *Daphnia”* (SERA 2010, SERA 2011b).
- Neither terrestrial nor aquatic applications of triclopyr TEA pose substantial risks to aquatic animals across the range of labeled application rates (SERA 2011c).

The aquatic invasive plant treatment strategy developed as a component of Alternative 3 adds a previously non-existent framework for rapid response to future invasion of aquatic invasive plant species to SCNF waters. Actual treatment strategies would be developed in response to site-specific infestations with collaboration with the Idaho state aquatic species coordinator and appropriate county program managers. As identified in the treatment examples described under the Overview of Alternatives section, managers would consider the available range of treatment options to implement eradication measures in the early stages of infestation.

With implementation of design criteria associated with potential aquatic invasive plant treatment actions undertaken under Alternative 3, it is unlikely that herbicide-related impacts to fisheries resources, fish food bases, or aquatic habitat integrity would occur. With rapid eradication response in the early stages of infestation, short-term reductions in the vegetative biomass at treatment sites in association with invasive aquatic invasive plant removal would not be expected to result in a significant short-term or long-term impacts to the available invertebrate fish food base. As with terrestrial invasive plant treatment operations, potential impacts on aquatic and riparian resources could occur if there was an accidental spill of a large amount of herbicide to target waters. The scope and magnitude of resulting effects would be dependent on various factors, including the volume of spill and factors influencing dilution in the receiving water. Adherence to project design criteria would minimize the likelihood of such a spill occurring, and would minimize or avoid the potential related impacts to aquatic resources.

The aquatic invasive plant treatment strategy would provide the SCNF a mechanism to implement a rapid response to new aquatic invasions of forest waters. Rapid response in the early stages of

invasion would allow more efficient eradication measures with minimal treatment scope compared to measures required for extensive and established infestations. In the event of future invasion of aquatic invasive plant species to forest waters, direct and indirect effects of implementation of this framework would be a reduced threat of both short and long term detrimental impact to aquatic and riparian habitat conditions through rapid containment and eradication, along with a reduction of risk of subsequent spread of aquatic invasive plant species to other waters.

Effects of Aquatic Invasive Plant Treamtnets to Federally-Threatened and Endangered and Forest Service Reigon 4 Sensitive Fish Species

Implementation of a strategic framework for aquatic invasive plant treatments on SCNF waters under Alternative 3 is not considered likely to adversely affect Federally-listed species occurring within the SCNF non-wilderness project area, including: Snake River spring/summer Chinook salmon, Snake River sockeye salmon, Snake River Basin steelhead, and Columbia River bull trout.

Direct effects to Federally-Threatened and Endangered, and Forest Service Region Sensitive fish species as a result of exposure to herbicides used under the SCNF's Current Action alternative are not likely to occur. Design criteria, including application of herbicides specifically selected for low toxicity and risk values to fisheries and aquatic invertebrates, minimize potentials for direct impact to fisheries resources or important food species.

Indirect effects to aquatic habitats, including designated critical habitats for Federally-listed species, are expected to be minimal and limited to temporary small scale aquatic vegetation reductions as a direct result of targeted aquatic invasive plant treatment. Removal of invasive plants would be expected to result in overall long-term beneficial effects as native aquatic vegetation replaces invasive infestations.

Effects to Forest Service Region 4 sensitive westslope cutthroat trout are similar to those identified for Federally-listed species. Identified actions to treat aquatic infestations would not likely contribute to a trend towards Federal listing, or cause a loss of viability to the population or be expected to result in a downward trend for the species.

Effects of Aquatic Invasive Plant Treatments to MIS Fish Species

Effects to SCNF MIS bull trout are as described above for TES species. Incorporating the identified design criteria, aquatic invasive plant treatments under Alternative 3 are not expected to be of sufficient nature or magnitude, or anticipated to be of a frequency of implementation, to result in measureable influence on the past or future trend of bull trout populations in the SCNF.

3.4.6.5. Alternative 4-No Aerial Herbicide Application

<u>Direct and Indirect Effects</u>

Alternative 4 would not include aerial application of herbicides as a treatment option. Herbicide treatment of terrestrial invasive plant infestations would be limited to ground-based application methods utilizing chemicals and applicable design criteria as identified under Alternative 2. Effects analysis scenarios, including Surface Runoff, Wind Drift, Leaching and Accidental Spill Worst Case Scenarios, would therefore be similar to those described for terrestrial herbicide applications under Alternative 2.

Direct and indirect effects of implementation of aquatic invasive plant treatments under this alternative would be identical to those described for Alternative 3.

Effect to Federally-listed TES fish species, Forest Service Region 4 sensitive fish species, and SCNF MIS fish species would be as described under Alternative 3.

Summary of Direct and Indirect Effects

The scope and magnitude of potential direct and indirect effects to aquatic resources and habitats of invasive plant treatments under Alternative 4 fall between that of the Current (Alternative 2) and Proposed Action (Alternative 3) alternatives. Without an aerial application option, potential effects of terrestrial invasive plant treatments would be similar to those of the Current Action alternative, but with a slight incremental level of additional potential effects risks related to use of additional herbicide formulations. Toxicities and calculated Risk Levels of the three new herbicides - aminopyralid, imazapyr and imazamox, however, are within the range of those used under the current program, and their addition under both the proposed action and this alternative would not constitute a significant elevation of risk of adverse effects to aquatic resources. As with both the Current and Proposed Action alternatives, terrestrial herbicide application design criteria would minimize potential risks of herbicide introduction to aquatic habitats.

There is currently no Forest strategy to address the threat of aquatic invasive plant introductions to waters of the SCNF. Inclusion of a new aquatic invasive plant EDDR strategy under Alternatives 3 and 4 places the SCNF in better position to rapidly respond to threats to aquatic habitats from new aquatic infestations.

As with both Alternatives 2 and 3, Alternative 4 would be expected to result in improved habitat conditions and reduced threats, over time, for aquatic and riparian resources in the SCNF. The same short term disturbances identified under Alternatives 2 and 3, may also occur under Alternative 4, with slight negative effects on aquatic resources in specific areas. Terrestrial infestations would progressively decline, most likely at a rate somewhere between those under the Current and Proposed Action alternatives. Reductions in infestations would reduce the potential for erosion and sediment delivery to drainages and benefit aquatic resources, particularly in the northern part of the SCNF.

As with Alternatives 2 and 3, with implementation of alternative-specific design criteria and an adaptive strategy, it is unlikely that any of the analyzed worst-case situations would occur or be expected to result in adverse impacts on populations of aquatic resources. Additionally, as with Alternatives 2 and 3, potential short-term impacts on aquatic and riparian resources could occur if there was an accidental spill of a relatively toxic herbicide in a small drainage, with resultant effects being dependent on various factors, including the volume of spill and dilution by the receiving water. As with all action alternatives, adherence to project design criteria would reduce the likelihood of an herbicide spill occurring, and would minimize or avoid the potential occurrence of wind-drift-related impacts on aquatic resources.

3.4.6.6. Alternative 5-No Aquatic Herbicide Application

Direct and Indirect Effects

Alternative 5 would retain both the ground and aerial herbicide application options, including the range of chemicals and applicable design criteria identified under Alternative 3. Effects analysis scenarios for ground based and aerial terrestrial herbicide treatments, including Surface Runoff, Wind Drift, Leaching and Accidental Spill Worst Case Scenarios, would therefore be similar to those described for terrestrial herbicide applications under Alternative 3.

While mechanical treatments of aquatic weeds could be employed, no aquatic herbicide treatments would be implemented under this alternative. There would, therefore, be no potential for direct or indirect effects related to application of herbicides to aquatic environments. While absent under alternatives 1 and 2, the SCNFs strategic response plan to aquatic weed infestations would be limited relative to that of alternatives 3 and 4 in not providing a herbicide based treatment option to address new infestations. Given the rate of spread of these species and the number of vectors possible to move the species to another location, it is probable that an aquatic plant, if introduced and not mechanically removed soon after detection, could become established.

Effects to Federally-listed TES fish species, Forest Service Region 4 sensitive fish species, and SCNF MIS fish species would be similar to those described under Alternative 3. There would be no potential for effects from herbicide-based treatments of aquatic invasive plants as described under Alternative 3.

Summary of Direct and Indirect Effects

The scope and magnitude of potential direct and indirect effects of terrestrial invasive plant treatment under Alternative 5 would be similar to those identified for Alternative 3. Like Alternative 3, Alternative 5 would be expected to result in the greatest rate of improved aquatic and riparian habitat conditions and reduced threats for aquatic and riparian resources from treatment of terrestrial invasive plants. Terrestrial infestations would be expected to progressively decline at rates similar to that under Alternative 3, reducing the potential for erosion and sediment delivery to drainages and benefiting aquatic resources. Declines would be most significant in the northern part of the SCNF, where infestations are extensive.

As with all action alternatives, short term disturbances may occur and may have a slight negative effect on aquatic resources in specific areas. Additionally, as with all action alternatives, potential short-term impacts on aquatic and riparian resources could occur if there was an accidental spill of a relatively toxic herbicide in a small drainage, with resultant effects being dependent on various factors, including the volume of spill and dilution by the receiving water. Implementation of alternative-specific design criteria and an adaptive strategy would make it unlikely that any of the analyzed worst-case situations would occur or be expected to result in adverse impacts on populations of aquatic resources. Adherence to project design criteria would reduce the likelihood of a herbicide spill occurring, and would minimize or avoid the potential occurrence of wind-drift-related impacts on aquatic resources.

In the absence of an herbicide based option aquatic invasive plant treatment under this alternative, potentials for direct or indirect effects related to treatment of aquatic invasive plants would be reduced, relative to those under Alternative 3. However, the efficacy of the SCNF's strategic

mechanism to address new infestations of aquatic weeds would be less robust under this alternative due to reliance on only manual removal methods.

3.4.6.7. Cumulative Effects for All Action Alternatives

Under Alternative 2, the SCNF currently implements an active program of invasive plant management, including ground based herbicide application, mechanical control, and biological control releases. Under Alternative 3, the SCNF would expand its current program of invasive plant management with the addition of three new herbicides, inclusion of an aerial herbicide application strategy, and development of an aquatic invasive plant treatment strategy. Alternatives 4 and 5 are variations of Alternative 3. Active invasive plant treatments, including each of these same treatment methods, would additionally continue to occur on private, county, state, and Bureau of Land Management lands through actions conducted by Cooperative Weed Management Area (CWMA) participants. Analysis of cumulative effects will therefore address an analysis area encompassing all land ownerships within the Upper Salmon River, Little Lost River and Big Lost River Basins.

Current ongoing and foreseeable SCNF forest management activities within this cumulative effects analysis area are identified in Appendix H of this document. Appendix H displays the three year average of applied acres of herbicide in Butte, Custer, and Lemhi Counties, as well as the herbicide use on the Salmon-Challis portion of the Frank Church-River of No Return Wilderness. The total land mass of Butte, Custer, and Lemhi Counties is 7,521,388 acres. The total known annual average acres of applied herbicide for these which is applied by CWMA partners is less than 5,000 acres, or 0.07% of the area. Private land makes up 8% of the counties. Even without knowing how much herbicide is applied to private land, the proportion of private land in relation to the three county-wide area is low. The applications of these herbicides are also spatially distinct. The herbicide applications identified under the Current Action alternative are not in the same locations as the applications identified in Appendix H. CWMA partners are licensed pesticide applicators, therefore herbicides were applied in compliance with label direction. None of the herbicides analyzed have an obvious cumulative adverse effects when used in combination with other herbicides. Given the relatively small proportion of treatment across the landscape, the implementation of design criteria designed and utilized to protect sensitive species, and the use of label guidelines for proper application, cumulative adverse effects to aquatic species are not expected from the implementation of any of the action alternatives. All the proposed treatments used in conjunction with treatment methods that neighboring land management agencies, landowners, and CWMA partners implement may serve to increase the efficacy of treatments which could result in beneficial cumulative impacts to aquatic habitats.

Cumulative effects from treatments from any of the action alternatives combined with treatments under the three CWMAs would result in benefits to aquatic habitat and resources compared to the No Action alternative through the widespread eradication, control, and containment of invasive plants. The CWMAs and the SCNF invasive plant management program would cumulatively be expected to result in increased levels of invasive plant treatment success. Invasive plant infestations in the SCNF would progressively decline. This would reflect the eradication, control, and/or containment of new invasive plants that have invaded the SCNF from adjacent lands covered by the CWMAs, and increased success in preventing invasive plants presently occurring in the SCNF from invading adjacent lands.

These effects could potentially benefit aquatic and riparian habitat and a range of protected and other sensitive management indicator species through reduced erosion and sediment delivery to drainages. Beneficial cumulative effects on aquatic resources may be greatest in the northern portion of the SCNF and on adjacent non-National Forest lands because of extensive spotted knapweed infestations that would be aggressively managed. No adverse downstream cumulative effects on non-National Forest land would be expected from worst-case situations involving herbicide runoff or leaching because of the extremely low concentrations. There is the potential for downstream adverse effects on aquatic and riparian resources if a herbicide spill or wind-drift-related impact occurred close to Forest Service boundaries. Increased flows proceeding downstream would further dilute the herbicide. Invasive plant management design criteria described previously are designed to prevent or reduce the risk of these types of impacts from occurring.

Additional cumulative effects on aquatic resources associated with other ongoing activities in the SCNF that were described for the No Action alternative would also occur under the action alternatives. These cumulative effects include the potential for erosion and sediment delivery from road and trail-related construction and maintenance activities, livestock grazing along drainages, and recreational activities adjacent to drainages. Also, cumulative effects on aquatic resources from invasive plant treatment activities under the action alternatives potentially include short-term increases in erosion and sediment delivery to drainages caused by more extensive mechanical treatments (soil disturbance) and chemical treatments (creation of barren ground from invasive plant removal) than under the No Action alternative. These areas would be subject to erosion until native vegetation becomes re-established, after which time erosion and sediment delivery should be less than when invasive plants were present and provide correspondingly greater benefits than under the No Action alternative. This would represent an overall long-term cumulative benefit to aquatic habitat and resources.

There is the possibility of herbicide application in adjacent areas (SCNF and CWMA) and possible cumulative effects on aquatic resources. However, the CWMA efforts are coordinated with the management agencies to avoid multiple treatments within a defined geographic location. In addition, all such applications would be in accordance with EPA label guidelines, which are designed to protect aquatic organisms. The Forest Service (USDA Panhandle National Forest 2001) discussed the potential for two additional types of cumulative effects on aquatic organisms from herbicide application. These are the potential for the bioconcentration of herbicides in aquatic organisms and the possibility of synergistic, combined effects on aquatic organisms when several herbicides are present. For bioconcentration to occur, a pollutant must be present in a high concentration for an extended period of time, the organism must be exposed to the pollutant, and the pollutant must have a high resistance to breakdown or excretion by the organism to allow a sufficient uptake period that would result in an elevated bioconcentration. The Forest Service (USDA Beaverhead-Deerlodge National Forest 2001) concluded that the risk of bioconcentration would be low because of the relatively small amount and timing of herbicide application. The risk of herbicide bioconcentration in aquatic organisms in the SCNF also would be expected to be low because of the extremely low concentrations of herbicides that aquatic organisms would be briefly exposed to during even a worst-case situation. In addition, the herbicides used to treat invasive plant infestations in the SCNF do not bioaccumulate in fish and/or have very little persistence in the environment (Information Ventures, Inc. 2002).

The Forest Service (USDA Beaverhead-Deerlodge National Forest 2001) concluded that no synergistic effects from herbicide application would occur. This was because: 1) the EPA currently

supports an additive model in predicting synergistic effects, 2) relatively small amounts of herbicides would be applied, and 3) where more than one herbicide is used the amount of each chemical applied would typically be reduced. This same rationale and conclusion regarding the potential for synergistic effects on aquatic resources also applies to the SCNF. In addition, because the chances of multiple different herbicide activities taking place in the same drainage on the same day are unlikely, the potential for cumulative synergistic effects on aquatic organisms in the SCNF would be minimal.

Aerial herbicide applications proposed by the SCNF under this alternative are not currently or foreseeably implemented by other CWMA partners, and there would be no potential cumulative effects related to aerial application operations. Nor do there appear to be any identifiable potential cumulative effects related to the SCNFs inclusion of an aquatic invasive plant treatment strategy.

3.5. Wildlife

3.5.1. Introduction

This specialist report analyzes the potential for effects to wildlife resulting from implementation of the alternatives both from the impacts of weeds and the impacts of weed control. This includes treatment of invasive plants using herbicides, mechanical methods and biological control agents.

The Salmon-Challis National Forest is required by law, regulation, and policy to address impacts to wildlife species of special designations. The effects of invasive plant treatment on the following species will be analyzed:

- Wildlife species listed as threatened, endangered, or candidate under the Endangered Species Act
- Salmon-Challis National Forest Management Indicator Species (MIS)
- USDA Forest Service Region 4 sensitive wildlife species
- Migratory birds and their habitat
- Ungulate big game species (elk)

3.5.2. Measurement Indicators

- Toxicity potential of herbicides being used
- Routes of exposure
- Adequacy of design criteria to protect wildlife
- Acres of herbicide application

3.5.3. Compliance with Forest Plan and Other Relevant Direction

The Salmon National Forest Land and Resource Management Plan (LRMP) (1988) provides forest-wide direction, standards, and guidelines regarding wildlife that is relevant to invasive plant treatments:

General Direction

- Provide habitat diversity through vegetation treatments in conjunction with other resource activities designed to maintain or improve wildlife or fisheries habitat.
- Coordinate range improvement and management activities with wildlife habitat needs, especially on key habitat areas such as winter ranges, calving areas, riparian areas, and sage-grouse leks.

Standards and Guidelines

- Habitat for each vertebrate wildlife species on the Forest will be managed to insure viable or target populations.
- Contribute to the local and State economics by providing favorable habitat for socially and economically important fish and wildlife species.
- Place emphasis on improving key ecosystems including but not limited to: riparian, aspen, aquatic, snag, and old growth.

Salmon LRMP prescription direction makes no recommendations specific to weed management and wildlife. General direction in prescription areas 2A and 4A is to manage key big game winter ranges to achieve and maintain big game population objectives; in prescription area 4B general direction is to manage key big game summer range areas to achieve and maintain optimum habitat for elk; and in prescription area 8A, resource management activities which would enhance elk habitat conditions may occur and maintain habitat capability for viable, or target populations of all species of vertebrate wildlife.

The Challis National Forest Land and Resource Management Plan (LRMP) (1987) provides forest-wide direction regarding wildlife that is relevant to invasive plant treatments:

- Habitat for each vertebrate wildlife species on the Forest will be managed to insure viable or target populations.
- Contribute to the local and State economics by providing favorable habitat for socially and economically important fish and wildlife species.
- Place emphasis on improving key ecosystems including but not limited to: riparian, aspen, aquatic, snag, and old growth.

Salmon LRMP prescription direction makes no recommendations specific to weed management and wildlife. General direction in prescription areas 2A and 4A is to manage key big game winter ranges to achieve and maintain big game population objectives; in prescription area 4B general direction is to manage key big game summer range areas to achieve and maintain optimum habitat for elk; and in prescription area 8A, resource management activities which would enhance elk habitat conditions may occur and maintain habitat capability for viable, or target populations of all species of vertebrate wildlife.

The Challis National Forest Land and Resource Management Plan (LRMP) (1987) provides forest-wide direction regarding wildlife that is relevant to invasive plant treatments:

- Emphasize habitat improvement for Threatened and Endangered Species, Forest Service Sensitive, and economically and socially important species.

Management area direction largely provides general direction and makes no recommendations specific to weed management other than prescriptions to manage wildlife habitat to maintain current habitat capability or improve habitat condition and diversity of elk, mule deer, bighorn sheep, and mountain goats; emphasize management of threatened and endangered species where appropriate; emphasize habitat management of big game and upland game birds; and improve wildlife habitat productivity through improvement projects and coordination with other resources.

The action alternatives are consistent with the Interim Conservation Recommendations for Greater Sage-Grouse and Greater Sage-Grouse Habitat (USDA Forest Service 2012c).

In addition to the LRMPs, laws and regulations such as the Endangered Species Act (ESA) of 1973 (as amended), the National Forest Management Act (NFMA) of 1976 (P.L. 4-588), the Migratory Bird Treaty Act of 1918, Executive Order 13186 (Responsibilities of Federal Agencies to Protect Migratory Birds), and Executive Order 13443 (Facilitation of Hunting Heritage and Wildlife Conservation) are considered for the analysis.

The action alternatives comply with the Salmon and Challis NF LRMP standards and guidelines specific to noxious weed and wildlife habitat management. The No Action alternative does not comply with the LRMPs.

The design criteria developed for all treatment methods, the herbicides analyzed, and the application methods in all the action alternatives comply with Forest Service Manual Forest Service Manual and Handbook (FSM 2150, FSM 2150 R4 supplement, FSH 2109.14, FSM 2670, FSM 6709.11) direction and are consistent with the Interim Conservation Measures for Sage-Grouse and Habitat, the Idaho and Southwestern Montana Greater Sage-grouse Proposed Land Use Plan Amendment and FEIS (2015), the ESA, EO 13186, and EO 13443.

3.5.4. Methodology for Analysis

The effects of herbicide use depend on the toxicity of the herbicide, the level of exposure to that herbicide, and the duration of that exposure. Risk assessments evaluate the potential effects to non-target plants, wildlife, human health, soils, and aquatic organisms from the herbicides considered for use in the SCNF.

In addition to the analysis of potential hazards to wildlife from the active ingredients in the herbicides, SERA Risk Assessments evaluated available scientific studies of potential hazards of other substances associated with herbicide applications: impurities, metabolites, inert ingredients, and adjuvants. There is usually less toxicity data available for these substances (compared to the herbicide active ingredient) because they are not subject to the extensive testing that is required for the herbicide active ingredients under the FIFRA.

The risk assessments considered worst-case scenarios including accidental exposures and application at maximum label rates. Although the risk assessments have limitations, they represent the best science available. The risk assessment methodologies and detailed analysis is incorporated into references of conclusions about herbicide toxicology in this document. Other relevant peer-reviewed literature was utilized in the document to analyze effects of herbicides on wildlife and the impacts of invasive plants on habitats.

Exposure Scenarios

For each ecological risk assessment, a set of general exposure scenarios based on the low, typical, and maximum label rates of the herbicides are analyzed. For wildlife, exposure scenarios included the animal being directly sprayed; ingestion of contaminated vegetation, prey species, or water; grooming activities; and indirect contact with contaminated vegetation (SERA 2007b).

Direct spray scenarios include a 20-gram mammal being sprayed directly over half of the body surface. One scenario is the absorbed dose over a 24-hour period based on the relationship between body weight and surface area. The other scenario is complete absorption of the dose over a 24-hour period due to grooming and increased dermal permeability. Direct spray scenarios are not given for large mammals unless toxicity date indicates that large mammals are more sensitive to the active ingredient than small mammals. The other direct spray is a honeybee with assumed complete absorption over a 24-hour period (SERA 2007b).

Indirect contact scenarios, both acute and chronic, are based upon ingestion of contaminated vegetation or prey. One is a 20-gram mammal consuming 3.6 grams (18% of body weight) of contaminated vegetation per day. One is for a 70-kilogram mammal, with caloric requirements for the animal and the caloric content of the vegetation used in the modeling. Acute scenarios assume that the vegetation was sprayed directly and that 100% of the diet is contaminated. Two chronic scenarios are modeled; the animal consumes vegetation for a 90 day period after herbicide application (consisting of 30% of the diet) , and the animal eats vegetation 25 to 100 feet from the application site, but 100% of the diet is assumed to be contaminated by drift. Both chronic exposure scenarios are modeled for large birds (4 kg), as well (SERA 2007b).

For predatory species, exposure scenarios for a small bird (10 g) and a small mammal (20 g) consuming contaminated insects (residue rates of 45-135 ppm per lb/acre) were modeled. The consumption of small mammals by predatory mammals or birds was modeled; the assumption made was that the small prey mammal was directly sprayed with 100% absorption. Both acute and chronic exposure scenarios for the consumption of contaminated fish by predatory birds were modeled; since birds consume more food per body unit than mammals, so the consumption of fish by predatory mammals was not analyzed (SERA 2007b).

The ingestion of contaminated water was also modeled. A 20 g mammal consumes about 0.005 L water/day which equates to 0.25 L/kg bodyweight per day. The acute exposure scenario was based on the field dilution rate and the amount spilled (generally assumed to be 200 gallons) and the chronic exposure scenario was based on the water contamination rate and the application rate of the herbicide (SERA 2007b).

Analysis Area

The analysis area is the non-wilderness portion of the Salmon-Challis National Forest. Direct and indirect effects will be analyzed by Ranger District and invasive plant management zones. Cumulative effects will be addressed at a county-wide level.

3.5.5. Affected Environment

The listing status, biological requirements, trend and potential occurrence of all the species listed in this section are available in the Salmon-Challis NF Invasive Plant Treatment Wildlife Specialist Report, pages 26-51.

3.5.5.1. Federally Listed or Proposed Species

Two specis listed as threatened under the Endangered Species Act could potentially occur within the Salmon-Challis National Forest (Table 3-41).

Table 3-41: ESA-listed Wildlife Species Occurrence in the Salmon-Challis National Forest by Ranger District

Species	Scientific Name	Status	Ranger Districts
Yellow-billed cuckoo	*Coccyzus americanus*	Threatened	N/A
Canada Lynx	*Lynx canadensis*	Threatened	C-YF, L, LR, MF, NF, S-C

C-YF: Challis-Yankee Fork Ranger District, L: Leadore Ranger District, LR: Lost River Ranger District, S-C: Salmon-Cobalt Ranger District, MF: Middle Fork Ranger District, NF: North Fork Ranger District

3.5.5.2. Region 4 Sensitive Species

Plants and animals designated as sensitive are identified by Regional Foresters as species for which population viability is a concern as evidenced by current or predicted downward trends in population numbers, density, or habitat (FSM 2670.5). The Forest Service must implement management practices that ensure that sensitive species do not become threatened or endangered and must implement management objectives for populations or habitat of sensitive species (FSM 2670.22).

Those animal species that are known or expected to occur on the Salmon-Challis National Forest include seven mammals, nine birds, and one amphibian (Table 3-42). The greater sage-grouse and the Columbia spotted frog, both Region 4 sensitive species, hve been designated as SCNF management indicator species (MIS) (USDA Forest Service 2004). These species are assessed under the MIS section.

Table 3-42: Salmon-Challis NF Region 4 Wildlife Sensitive Species Occurrence by Ranger District

Species	Scientific Name	Ranger District
Gray Wolf	*Canis lupus*	C-YF, L, LR, MF, NF, S-C
Wolverine	*Gulo gulo*	C-YF, L, LR, MF, NF, S-C
Fisher	*Martes pennanti*	L, MF, NF, S-C
Bighorn sheep	*Ovis canadensis*	C-YF, L, LR, MF, NF, S-C
Spotted bat	*Euderma maculatum*	MF
Townsend's big-eared bat	*Corynorhinus townsendii*	LR, NF, S-C
Pygmy rabbit	*Brachylagus idahoensis*	C-YF, L, LR
Greater sage-grouse	*Centrocercus urophasianus*	C-YF, L, LR, S-C
Bald eagle	*Haliaeetus leucocephalus*	C-YF, L, NF, S-C

Species	Scientific Name	Ranger District
Northern goshawk	*Accipiter gentiles*	C-YF, L, NF, S-C
Peregrine falcon	*Falco peregrinus anatum*	C-YF, LR, NF, S-C
Boreal owl	*Aegolius funereus*	MF, NF, S-C
Flammulated owl	*Otus flammeolus*	C-YF, MF, NF, S-C
Great gray owl	*Strix nebulosa*	C-YF, L, MF, NF, S-C
Three-toed woodpecker	*Picoides tridactylus*	C-YF, L, MF, S-C
Harlequin duck	*Histrionicus histrionicus*	NF, S-C
Columbia spotted frog (also MIS)	*Rana luteiventris*	C-YF, L, LR, MF, NF, S-C
C-YF: Challis-Yankee Fork Ranger District L: Leadore RD	LR: Lost River RD MF: Middle Fork RD	NF: North Fork RD S-C: Salmon-Cobalt RD

3.5.5.3. Management Indicator Species

The Management Indicator Species lists were identified in the Forest Plan Amendments of February 3, 2004 (USFS 2004). For both the Salmon and the Challis National Land and Resource Management Plans, the bull trout, greater sage-grouse, pileated woodpecker, and Columbia spotted frog were selected. Of these only the latter three species are covered in this document.

Table 3-43: Salmon-Challis NF Management Indicator Occurrence by Ranger District

Species	Scientific Name	Ranger District
Pileated Woodpecker	*Dryocopus pileatus*	C-YF, L, LR, MF, NF, S-C
Greater sage-grouse	*Centrocercus urophasianus*	C-YF, L, LR, S-C
Columbia spotted frog	*Rana luteiventris*	C-YF, L, LR, MF, NF, S-C
C-YF: Challis-Yankee Fork Ranger District L: Leadore RD	LR: Lost River RD MF: Middle Fork RD	NF: North Fork RD S-C: Salmon-Cobalt RD

3.5.5.4. Migratory Birds

The Idaho Bird Conservation Plan (ID PIF 2000) lists bird species that are prioritized based on a number of factors, including relative density in planning unit compared to maximum in range, population trend, threats in breeding habitat, relative abundance, size of breeding range, size of non-breeding range, and threats in non-breeding habitat. High priority species are those species that scored high in the PIF prioritization process, which indicates a high vulnerability of populations. A complete explanation of the rationale is found in the Idaho Bird Conservation Plan, Version 1.0. Rather than taking only a species-based approach to conservation, habitat types are also prioritized. One factor used for prioritization is the number of bird species that use that use a particular habitat type as primary breeding habitat.

Within the analysis area, the alpine, high elevation mixed conifer forest, lodgepole pine, low elevation mixed conifer, ponderosa pine, juniper/pinyon/mountain mahogany, aspen, sagebrush, non-riverine wetland, riparian, and cliffs/rock outcrops/talus Idaho PIF avian habitats occur (ID PIF 2000).

Table 3-44: Regional Population Trend for High Priority Breeding Birds in the SCNF

Habitat Type	Species[1]
Alpine	Black Rosy-Finch
Sagebrush Shrub	Swainson's Hawk
	Sage Grouse
	Short-eared Owl
	Loggerhead Shrike
	Sage Thrasher
	Rock Wren
	Brewer's Sparrow
	Lark Sparrow
	Sage Sparrow
Grassland	Long-billed Curlew
	Grasshopper Sparrow
	Western Meadowlark
High-elevation Mixed Conifer	Olive-Sided Flycatcher
	Hammond's Flycatcher
Low-elevation Mixed Conifer	Sharp-shinned Hawk
	Lewis' Woodpecker
	Williamson's Sapsucker
	Black-backed Woodpecker
	Brown Creeper
	Varied Thrush
	Townsend's Warbler
	Western Tanager
Ponderosa Pine Forest	Flammulated Owl
Juniper/Pinyon/ Mt. Mahogany	Ferruginous Hawk
	Plumbeous Vireo
Riparian	Barrow's Goldeneye
	Hooded Merganser
	Blue (Dusky) Grouse
	Black-chinned Hummingbird
	Calliope Hummingbird
	Rufous Hummingbird
	Willow Flycatcher
	Dusky Flycatcher
	American Dipper
	Yellow Warbler
	MacGillivray's Warbler
Non-Riverine Wetlands	Cinnamon Teal
	Redhead
	Sandhill Crane
	Killdeer
Aspen	Ruffed Grouse
Cliffs/Rock Outcrops/Talus	Golden Eagle
	Prairie Falcon

[1] All above birds, except game birds, are protected under the Migratory Bird Treaty Act
[3]One of three species of sapsuckers- data combined

3.5.5.5. Ungulates (Elk)

Elk occur in every Invasive Plant Management Zone in the SCNF.

3.5.6. Environmental Consequences

This alternative is required by regulation (40 Code of Federal Regulations (CFR) 1502.14). No invasive plant management treatments would be applied to any non-wilderness National Forest System (NFS) lands. The alternative provides a baseline for comparison and analysis of effects.

There would be no herbicide application (ground based or aerial application), mechanical methods (hand or tool grubbing, mowing), revegetation, or biological control. Existing biological controls would be allowed to progress naturally, but no supplementation would occur. Ongoing invasive plant prevention and education would still continue, but additional measures would not.

For analysis purposes, the average rate of annual spread, without active control actions, was used to estimate the increase in infested acres (Duncan and Clark 2005). The current inventoried acres were used as the basis for calculating the average rate of spread data for species that had that data available (Table 3-45). This calculation is for the purposes of analysis comparison. In a real world scenario, factors such as precipitation, ecological condition, and disturbance would influence the rate at which invasive plants would spread.

Table 3-45: Calculated Rate of Spread of Selected Invasive Plant Species

Noxious Weeds	Current Infested Acres	Average Annual Spread Rate (%)	Year 5 (Acres)	Year 10 (Acres)
Leafy spurge	865	12%	1,524	2,687
		16%	1,817	3,816
Spotted knapweed	39,205	10%	63,140	101,688
		24%	114,934	336,944
Canada thistle	2,642	10%	4,255	6,853
		12%	4,656	8,206
Perennial pepperweed	0.2	11%	0	1
		18%	0	1
Dalmatian toadflax	123	8%	181	266
		29%	439	1,570

Invasive plant species are recognized as a threat to biodiversity. Invasive plant influence community structure by having effects on plant community structure and by having impacts on higher trophic levels and impact ecosystem processes such as nutrient cycling, hydrology, and fire regimes (Levine et al. 2003). Invasive exotic plants influence community structure by influencing energy, nutrients, and water out of proportion to their presence on the landscape (Trammel and Butler 1995). The pathways and mechanisms that cause the effects are not thoroughly understood; although competition of introduced invasive plants with native species has been well documented (Levine et al. 2003). For example, invasive plants, such as spotted knapweed, have created near monocultures in areas where the plant has invaded (Thorpe et al. 2009). Increase in the cover of leafy spurge correlated to a decline in the abundance of dominant native plant species both on a large scale and within infestation (Belcher and Wilson 1989). Invasive annual grasses provide sufficient fuel loading

to reduce fire return intervals and eliminate fire sensitive shrubs, thus altering the native plant community and allowing for other invasive plants to invade (Pyke et al. 2000).

Invasive plant infestations do have demonstrable effects on wildlife species. The effects weeds have on ungulates and effects ungulates on weeds have been the focus of many studies. Intensive herbivory by ungulates can facilitate the invasion, establishment, and spread of invasive plants because invasive plants tend to be tolerant to ground disturbance, adapted to be easily transported by animals on fur or in guts, and are not very palatable in comparison to native species (Vavra et al. 2007).

Elk pellet counts found that there were substantially more pellets in bunchgrass sites compared to knapweed-dominated sites. Elk will graze knapweed in the fall, but in the winter, their diet is predominately comprised of grasses. However, one study found that invasive species (cheatgrass and knapweed) did comprise a sizeable percentage (approximately 19%) of their diet in the winter and spring (Kohl et al. 2012). Both elk and deer will graze on knapweed rosettes in the spring, but that is likely a function of availability rather than preference (Beck 1994). Deer pellet groups were reduced by >70% in areas infested by leafy spurge, likely due to decreased forage production and avoidance of infested areas as forage areas. Leafy spurge can act as an emetic, purgative, and irritant when ingested. As the number of infested sites increase, the overall carrying capacity is reduced, which may result in over-grazing/browsing in uninfested areas (Trammel and Butler 1995). Leafy spurge infestations displace native vegetation and create plant communities that are incompatible as feed for native ruminants (Leistritz et al. 2004). Bighorn sheep rely on a diverse diet to meet their nutritional needs. Invasive plants reduce plant diversity, therefore could result in reduce habitat quality for bighorn (Wagner and Peek 2006).

Sage-steppe habitats invaded by annual grasses and noxious weeds results in a simplified plant community structure and altered species composition, which reduces habitat quality and quantity by decreasing the availability of appropriate forage or cover plant species needed by sage-grouse (ID SGAC 2006).

There are effects to wildlife species are not directly affected by loss of forage habitat quality. The volume of native vegetation in an area was found to correlate with native bird density and species richness (Mills et al. 1989). Leafy spurge has been found to result in a decline of nest success in grassland bird species due to reduced habitat quality (Scheiman et al. 2003). Chipping sparrows nest in trees and forage on the ground. In sites invaded by knapweed, grasshopper numbers were reduced. It was found that the initiation of the first nest attempt was delayed was associated with low food availability. Delays in breeding could result in lower fecundity and could also reduce site fidelity (Ortega et al. 2006). Native plants support more Lepidopteran species than introduced plants; native woody species support more than herbaceous species. Lepidoptera are a primary prey species for bats. Invasive plants have food-chain effects, which could result in impacts to consumer species such as songbirds and bats (Ortega et al. 2006).

Non-native plant infestations changes vegetation composition and structure and can change disturbance regimes (Knick et al. 2003, Brooks and Pyke 2002). Increased fire frequency can alter the sage-brush structure required by sage-brush obligate species such as sage-grouse and pygmy rabbits. Invasive plant species have been found to play a role in bird species homogenization, especially in bird species that have small ranges (Clavero et al. 2009).

A study found that spotted knapweed had a positive effect on mouse abundance in an early seral site likely because of increased food availability in the form of seeds and bio-control insects. The increase in mouse populations could be detrimental to community structure by resulting in poor seedling recruitment of native plants, overconsumption of mycorrhizal fungi, and heavy predation on native plant seeds and beneficial insects. The presence of spotted knapweed did not appear to have an effect on small mammal species diversity, although many other aspects could have influenced the result (Malick et al. 2012). Another study found that rodent abundance and species richness was greater in native sagebrush communities than in cheatgrass dominated areas. This could be attributed to a reduction in habitat suitability- such as quality and quantity of forage and impaired habitat structure such as lack of hiding cover. Changes in rodent populations can affect plant communities due to altered seed dispersal and predations (Ostoja and Schupp 2009). The disparities can be explained because rodent communities are very dynamic regarding species composition and density and react differently to various introduced plant species. Relationships between introduced plants and native rodents can be antagonistic or symbiotic, depending upon the combination of plants and animals on any given site (Young and Longland 1996).

Aquatic plants have the ability to affect water current speed and depth, the amount of surface available for organisms to attach, amount of oxygen available in the water column, and can change nutrient cycling and the amount and quality of primary production and detritus. Invasive aquatic plants have the potential to affect nearly every aspect of an aquatic ecosystem structure and function (Strayer 2010). Invasive plants can affect amphibians and reptiles by altering habitat structure, herbivory and predator/prey interactions, and reproductive success (Martin and Murray 2011).

3.5.6.1. Alternative 1-No Action

Direct and Indirect Effects

Federal Listed or Candidate Species

Yellow-billed Cuckoo

Although they have not been documented as breeding in the SCNF, cuckoos would be particularly susceptible to the invasion of salt cedar since this plant does not provide adequate nesting to foraging habitat (Laymon 1998). Currently there are 0.5 acres of identified salt cedar in the North and Salmon zones (Table 1-1).

Effects Determination

Due to the lack of observations of this species in the SCNF and the very low acres of salt cedar infestation, it seems as there would be no impact. However, the lack of active control could result in salt cedar increasing in amount and range in the SCNF and could reduce the quality and quantity of potential habitat. However, the SCNF does not represent a primary habitat stronghold of the species.

The No Action alternative may affect, but is not likely to adversely affect individual yellow-billed cuckoos.

Canada Lynx

There is no documentation of the potential magnitude of effects of invasive plants on lynx habitat; however, the potential exists for large-scale impacts and alteration of habitat (Reudiger et al. 2000). The primary prey species, snowshoe hare, eat conifers during the winter and herbaceous vegetation in the summer. Invasive plant infestations may impact prey forage during summer months, but the potential effect on population cycles is not documented in the literature.

Effects Determination

The No Action alternative may affect, but is not likely to adversely affect Canada lynx.

Region 4 Sensitive Species

Gray Wolf

Direct habitat impacts from invasive plant invasion would be difficult to qualify. However, impacts to prey species, primarily ungulates, could be considerable. Using the rate of spread in Table 3-45, the number of acres infested in 10 years could be as high as approximately 112,000 acres to 351,000 acres, depending on rates of spread. The increase in infested acres would likely result in a decrease in forage quality and quantity for ungulates which would affect the available prey base for wolves.

Effects Determiniation

The No Action alternative may impact individual wolves, but would not likely contribute to a trend towards Federal listing.

Wolverine

Effects of invasive plants to wolverine would likely manifest in effects to ungulate prey species, rather than to effects to habitat.

Effects Determination

The No Action alternative may impact individual wolverines, but would not likely contribute to a trend towards Federal listing.

Fisher

Effects from invasive plants would be expected to be to prey species, rather than directly to fisher. However, since fishers are prey generalists, these impacts would be difficult to quantify. For example, there may be a negative impact to ungulate species (therefore reduced carrion availability), yet an increase in deer mice.

Effects Determination

The No Action alternative may impact individual fisher, but would not likely contribute to a trend towards Federal listing.

Bighorn Sheep

There are 1,940,796 acres of modeled bighorn sheep habitat within the proposed action area. Within those modeled habitat acres, there are 28,095 acres of known invasive plant infestations, the majority of which (21,915 acres) are spotted knapweed (Appendix P). Using the rate of spread in Table 3-45, the number of acres infested by spotted knapweed in modeled bighorn sheep habitat in

10 years could be as high as approximately 56,842 acres to 188,347 acres, depending on rates of spread. This would result in reduced forage quality and quantity.

Effects Determination

The No Action alternative may impact individual bighorn sheep, but would not likely contribute to a trend towards Federal listing.

Spotted Bat

A reduction in prey species, especially moths, could be the result of a large increase in invasive plant infestations. Invasive plants have food-chain effects, which could result in impacts to consumer species such as bats (Ortega et al. 2006).

Effects Determination

The No Action alternative may impact individual spotted bats, but would not likely contribute to a trend towards Federal listing.

Townsend's Big-eared Bat

A reduction in prey species, especially moths, could be the result of a large increase in invasive plant infestations. Invasive plants have food-chain effects, which could result in impacts to consumer species such as bats (Ortega et al. 2006).

Effects Determination

The No Action alternative may impact individual Townsend's big-eared bats, but would not likely contribute to a trend towards Federal listing.

Pygmy Rabbit

There are currently 12,245 acres of known invasive plant infestations within modeled pygmy rabbit habitat. The greatest amount of acreage of those infestations (7,866 acres) is spotted knapweed, followed by Canada thistle (1,403), musk thistle (1,239 acres), and leafy spurge (746 acres) (Appendix P). Using the rate of spread in Table 3-45, the number of sage-grouse habitat acres infested in 10 years by spotted knapweed could be 20,402to 67,604; Canada thistle, 3,639 to 4,358; and leafy spurge, 2,317 to 3,291.

Effects Determination

The potential of exponential spread of the invasive plants most commonly found in sage-steppe habitats in the SCNF has the potential to negatively impact the populations of pygmy rabbits present in the SCNF. The No Action alternative would be detrimental to local populations, but not to the species as a whole.

The No Action alternative may impact individual pygmy rabbits, but would not likely contribute to a trend towards Federal listing.

Bald Eagle

Most nesting and wintering habitat in the area is adjacent to large rivers, which generally have adjacent roadways. Although invasive plant infestations may affect ungulate populations, it would be expected that the number of vehicle mortalities would remain high since ungulates would

continue to use these areas for watering and foraging purposes. Carrion would remain available as a food source for eagles. Currently the SCNF has no known infestations of noxious aquatic invasive plants. However, if there was to be an introduction of one or more of these species, the lack of control measures available on SCNF lands could result in a substantial infestation, which could affect fish habitat.

Effects Determination

The No Action alternative may impact individual bald eagles, but would not likely contribute to a trend towards Federal listing.

Northern Goshawk

Direct impacts to habitat would not be expected; rather, impacts would be expected to be to avian prey species. Impacts from invasive plant infestations could result in reduced bird density, species richness, and nest success.

Effects Determination

The No Action alternative may impact individual Northern goshawk, but would not likely contribute to a trend towards Federal listing.

American Peregrine Falcon

Impacts to nesting habitat would not be expected. Rather, impacts would be expected to be to avian prey species. Impacts from invasive plant infestations could result in reduced bird density, species richness, and nest success.

Effects Determination

The No Action alternative may impact individual peregrine falcons, but would not likely contribute to a trend towards Federal listing.

Boreal Owl

Direct impacts to habitat would not be expected. Impacts to small mammals from invasive plants had not been well documented in the literature; impacts range from increasing populations of common species to decreasing diversity and abundance of native rodent populations due to the very dynamic relationship between small mammals and plant communities. Impacts would be expected to be to avian prey species resulting in reduced bird density, species richness, and nest success.

Effects Determination

The No Action alternative may impact individual boreal owls, but would not likely contribute to a trend towards Federal listing.

Flammulated Owl

Direct impacts to nesting habitat would not be expected. A reduction in insect prey species could be the result of a large increase in infestations. Invasive plants have food-chain effects, which could result in impacts to consumer species such as birds (Ortega et al. 2006).

Effects Determination

The No Action alternative may impact individual great grey owls, but would not likely contribute to a trend towards Federal listing.

Great Gray Owl

Direct impacts to nesting habitat would not be expected. Impacts to small mammals from invasive plant invasion had not been well documented in the literature; impacts range from increasing populations of common species to decreasing diversity and abundance of native rodent populations due to the very dynamic relationship between small mammals and plant communities. Impacts would be expected to be to avian prey species resulting in reduced bird density, species richness, and nest success.

Effects Determination

The No Action alternative may impact individual great grey owls, but would not likely contribute to a trend towards Federal listing.

Three-toed Woodpecker

Direct impacts to nesting habitat would not be expected. A reduction in insect prey species could be the result of a large increase in invasive plant infestations. Invasive plants have food-chain effects, which could result in impacts to consumer species such as birds (Ortega et al. 2006).

Effects Determination

The No Action alternative may impact individual three-toed woodpeckers, but would not likely contribute to a trend towards Federal listing.

Harlequin Duck

Since harlequin ducks are invertivores, invasive aquatic invasive plants have the potential to affect the prey base.

Effects Determination

Due to the very low number of observations of this species in the SCNF, it seems as there would be no impact. However, the lack of active control could result in aquatic invasive plants showing up in waterways in the SCNF and could reduce the quality and quantity of potential habitat.

The No Action alternative may impact individual harlequin ducks, but would not likely contribute to a trend towards Federal listing.

Management Indicator Species

Pileated Woodpecker

Direct impacts to nesting habitat would not be expected. A reduction in insect prey species could be the result of a large increase in invasive plant infestations. Invasive plants have food-chain effects, which could result in impacts to consumer species such as birds (Ortega et al. 2006).

Effects Determination

The No Action alternative would not be expected to result in a downward trend for this species.

Greater sage-grouse

There are currently 12,245 acres of known invasive plant infestations within modeled sage-grouse habitat. The greatest amount of acreage of those infestations (7,866 acres) is spotted knapweed, followed by Canada thistle (1,403), musk thistle (1,239 acres), and leafy spurge (746 acres) (Appendix P). Using the rate of spread in Table 3-45, the number of sage-grouse habitat acres infested in 10 years by spotted knapweed could be 20,402 to 67,604; Canada thistle, 3,639 to 4,358; and leafy spurge, 2,317 to 3,291.

Effects Determination

The potential of exponential spread of the invasive plants most commonly found in sage-steppe habitats in the SCNF has the potential to negatively impact sage-grouse. Although the SCNF contains suitable habitats and populations of sage-grouse, it does not represent a sizeable portion of that habitat. The No Action alternative would be detrimental to local populations, but not to the species as a whole.

The No Action alternative may impact individual sage-grouse, but would not likely contribute to a trend towards Federal listing.

Columbia Spotted Frog

Aquatic invasive plants would have potential to have direct impacts on habitat by means such as altering structure, plant composition, and oxygen levels. Indirect effects could occur as a result of changes to the prey bases and nutrient cycling.

Effects Determination

The No Action alternative may impact individual spotted frogs, but would not likely contribute to a trend towards Federal listing, or cause a loss of viability to the population or species or be expected to result in a downward trend for this species.

Migratory Breeding Bird

Detrimental direct and indirect impacts to nesting and foraging habitat and prey species could occur resulting from changes in vegetation composition and structure and changes in disturbance regimes. Impacts from invasive plant infestations could result in reduced bird density, species richness, and nest success. A reduction in insect prey species could be the result of a large increase in invasive plant infestations. Invasive plants have food-chain effects, which could result in impacts to consumer species such as birds (Ortega et al. 2006).

Ungulates

Detrimental direct and indirect habitat impacts from invasive plants to ungulates could be considerable. Using the rate of spread in Table 3-45, the number of acres infested in 10 years could be as high as approximately 112,000 acres to 351,000 acres, depending on rates of spread. The increase in infested acres would likely result in a decrease in forage quality and quantity for ungulates.

Cumulative Effects

There would be no cumulative effects from treatment activities because no treatment activities would be undertaken in this alternative.

Under the No Action alternative, human activities, animal movements across the landscape, and natural events would continue to contribute to the dissemination of invasive plant seeds and root fragments.

Existing invasive plant infestations would persist, new infestations would establish and new invaders would arrive. The No Action alternative would contribute to cumulative increases in invasive plants in terms of number, size and density of infestations. The increase in acreage infested with very difficult to control rhizomatous species such as leafy spurge would result in permanent establishment of these species (Sheley and Petroff 1999). Increases in species with seeds that cling to clothing, equipment or animal fur, such as houndstongue, would result in seeds being transported far more widely and establishing in new areas.

Events such as flooding, fire and drought would continue to create disturbed areas susceptible to invasion. In conjunction with the cessation of invasive plant control, these natural events would have cumulative negative impacts to native vegetation. For example, invasive plant species could spread more rapidly in burned areas because post-fire conditions often favor many of the invasive plant species that occur in the SCNF. These characteristics include recent soil disturbance, opening of the overstory canopy, soil damage from heat, removal of competing native vegetation and fire suppression activities by hand crews, equipment and vehicles that could spread existing and introduce new invasive plant seed and rhizomes.

New invaders (i.e. species that do not currently occur on SCNF) could become common and widespread if they were introduced onto lands on the Forest. Eventually, existing and new invasive plants could colonize and occupy all suitable habitats. The cessation of detection and rapid response efforts could result in the establishment and spread of new invasive plant species and new infestations.

Since invasive plant management in the SCNF would be discontinued under the No Action alternative, the SCNF would become a source of invasive plant seeds and root fragments for other parts of Butte, Custer and Lemhi Counties, with spread occurring through human activities, animal movements, and water and wind. For example, since there would be no invasive plant control at Forest Service administrative sites (e.g. vehicle parking lots or horse pastures), at recreation areas or fire camps. As invasive plant seeds were brought in from other places, they would establish new infestations in places such as these with heavy traffic or human use. Then they would begin to spread out along roads and trails and streams from the initial point of origin.

Habitat impacts that result from invasive plants infestation would become more pronounced as invasive plants became more abundant over the landscape. This would affect the quality and quantity of forage, nesting substrate, and cover. The invasive plants infestations could become severe enough to affect populations of wildlife, elk for example. This could increase grazing pressure on private lands or cause the population numbers to decease in the severely affected area.

3.5.7. Environmental Consequences

3.5.7.1. All Action Alternatives

Potential Effects from Biological Treatments

Biological control is the preferred method in remote areas where access is limited, on large extensive populations where other control methods may not be appropriate, on species where biological control agents are available and proven effective, and in conjunction with other control methods to reduce density of the target species. Only APHIS and state approved biological control agents proven not have a negative impact on non-target species would be released.

Deer mice eat native forb and grass seeds, yet avoid knapweed seeds. Deer mice also utilize *Urophora* spp., a biocontrol insect used to control spotted knapweed, as a food source. In areas that have knapweed infestations and abundant populations of *Urophora* spp., deer mice populations could increase. Larger populations of mice result in more seed predation on native forbs and grasses. Urophora spp. may exacerbate negative effects of knapweed on native plants through second-order competition (Pearson and Calloway 2008).

Potential Effects from Manual and Mechanical Treatments

Manual and mechanical treatments are used to remove seed heads, individual plants, and small infestations. These treatment methods are slow, very labor intensive, and are effective only for small infestations. Manual treatments include hand pulling invasive plants; using hand tools such as clippers, hoes, rakes, and shovels; and smothering or covering areas. Mechanical treatments include using power tools such as mowers, torches, or string trimmers. These treatments could result in bare ground and soil disturbance, albeit in a relatively small areas. Non-target species (generally plants) could be trampled. However, because of the targeted treatment methods, damage to non-target species could also be low. The slowness of the pace of work could also give animals the chance to leave the treatment area and reduce the risk of direct harm.

Mechanical treatment methods tend to be loud, especially in comparison to other treatment methods. This could disturb secretive animals and species sensitive to noise, causing them to leave the project area for at least the duration of the treatment, which would tend to be sort-term (generally no more than a few consecutive days). Some mechanical equipment, such as mowers, could potentially crush less mobile animals or nests. Areas that could be accessed by larger, less selective equipment would likely be close to motorized routes or within developed recreation or administrative sites and would likely not constitute preferred habitat. Handheld equipment would be more selective and would be less likely to cause direct harm to animals or nests. The nature of the treatment is to decrease cover, which, for small animals, could result in disruption of dispersal and foraging areas result in some increased predation due to greater exposure. Impacts as a result of cover loss would be short-term (one growing season).

Potential Effects from Herbicide Treatments

Toxicity tests required by EPA for pesticide registration include acute (short term) or chronic (longer term) exposures. Herbicides are subjected to long-term animal studies that test for effects and compliance with federal safety standards for human health. Toxicity tests required by EPA for pesticide registration include acute (short term) or chronic (longer term) exposures.

Acute toxicity can be a function of the amount of toxicant received, the route of administration, and the type of animal tested. Acute reactions tested include oral, dermal, and inhalation toxicity, and eye and dermal irritation. Table 3-46 displays acute toxicity categories for the assessed herbicides.

Chronic toxicity results from prolonged, repeated or continuous exposure to a chemical, typically at levels lower than those that cause acute toxicity. It often demonstrates a delayed response. Public concerns toward herbicides generally focus on potential chronic toxicity. Sublethal poisoning or exposure may be expressed by any of the following: skin/eye irritation; nervous system disorders; reproduction system disorders; damage to other organ systems (liver, kidney, lungs, etc.); birth defects; mutations; and cancer.

The EPA evaluates carcinogenicity, teratology (birth defects), mutagenicity, and endocrine system disruption study results of herbicide effects to animals during the herbicide registration process. The study data is used to make inferences relative to human health.

Table 3-47 displays acute effects of assessed herbicides, and Table 3-48 displays chronic effects of assessed herbicides.

Table 3-46: EPA Toxicity Categories

Toxicity Category	Signal Word	Toxicity Classification	Oral (Mg/kg)	Dermal (mg/kg)	Inhalation (mg/L)	Eye Irritation	Skin Irritation
I	DANGER Poison	High	0 –50	0 –200	0 – 0.2	Corrosive: corneal opacity not reversible	Corrosive
II	WARNING	Moderate	>50 - 500	>200 – 2000	>0.2 – 2.0	Corneal opacity reversible within 7 days; irritation persisting for 7 days	Severe irritation at 72 hours
III	CAUTION	Low	>500 – 5000	>2000 – 20,000	>2.0 – 20	No corneal opacity; irritation reversible within 7 days	Moderate irritation at 72 hours
IV	NONE	Very Low	>5000	>20,000	>20	No irritation	Mild or slight irritation at 72 hours

Table 3-47: Human Hazards Based on Acute Toxicity Categories

Herbicide	Acute Oral Toxicity	Acute Dermal Toxicity	Acute Inhalation	Primary Eye Irritation	Primary Skin Irritation
2,4-D amine	Moderate	Moderate	Low	High	Very Low
Aminopyralid	Very Low	Very Low	Very Low	Very Low	Very Low
Chlorsulfuron	Very Low	Low	Low	Low	Very Low
Clopyralid	Low[1]	Low	Low	Moderate	Very Low
Dicamba	Low	Low	Very Low	Moderate	Moderate
Glyphosate	Low	Low	Low	Low	Very Low
Imazamox	Very Low	Very Low	Very Low	Moderate[2]	Very Low
Imazapic	Very Low	Very Low	Low	Low	Very Low
Imazapyr	Very Low	Very Low	Low	Low	Very Low
Metsulfuron-methyl	Very Low	Low	Moderate	Low	Low
Picloram	Low	Low	High	Low	Very Low
Sulfometuron methyl	Very Low	Very Low	Low	Low	Low
Triclopyr TEA	Low	Low	Low	High	Low

[1] Low for technical grade, which is not used by the USFS; very low for formulation used by USFS
[2] Moderate for technical grade, very low for formulation used by USFS

Table 3-48: Human Hazards Based on Chronic Toxicity Categories

Herbicide	Carcinogen	Teratogen	Reproductive	Mutagen	Endocrine Disruptor
2,4-D amine	Not classifiable	Unlikely	Unlikely	Unlikely	Unknown
Aminopyralid	Not likely to be carcinogenic	No Effects	No Effects	No Effects	No Evidence
Chlorsulfuron	Evidence of non-carcinogenicity	No Effects	No Evidence	No Effects	No Evidence
Clopyralid	Evidence of non-carcinogenicity	No Effects	No Effects	No Effects	No Evidence
Dicamba	Not classifiable	Unlikely	No Effects	No Effects	No Information
Glyphosate	Evidence of non-carcinogenicity	Unlikely	Unlikely	No Effects	Unlikely
Imazamox	Not likely to be carcinogenic	No Effects	No Effects	No Effects	No Evidence
Imazapic	Evidence of non-carcinogenicity	No Effects	No Effects	No Effects	No Evidence
Imazapyr	Evidence of non-carcinogenicity	No Effects	No Effects	No Effects	No Evidence
Metsulfuron methyl	Not likely to be carcinogenic	No Effects	No Effects	No Effects	No Evidence
Picloram	Evidence of non-carcinogenicity	No Effects	No Effects	No Effects	No Effects
Sulfometuron methyl	No evidence of carcinogenic activity	Unlikely	Unlikely	No Effects	No Evidence
Triclopyr TEA	Not classifiable	No Effects	No Effects	No Effects	No Evidence

No Effects = No effects have been shown in laboratory tests and is not considered a hazard to humans.
Unlikely = Inconsistent or isolated effects have been shown in laboratory tests and it is not considered a hazard to humans at expected exposure levels.

Unknown = Laboratory tests are inconclusive or further testing is required.
Not Classifiable= Inadequate evidence of carcinogenicity or for which no data are available.

All herbicide applicators are required to follow the label directions for application rate and usage. The herbicide label is the primary communication on how to safely handle and use the product. It reflects the numerous scientific studies and regulatory reviews generated by the EPA registration process, which provides reasonable assurance that the potential benefits of use outweigh any potential risks: that, when used according to label directions, it will not cause unreasonable adverse effects on humans, fish and wildlife, or the environment. The law requires herbicide users to read and follow label specifications. FIFRA, as currently amended, allows use of an herbicide at rates up to those approved on the label.

In addition to following label directions, the Forest Service requires an additional level of risk assessment. The inherent hazard (toxicity) of the herbicide, an estimate of exposure, and the response of the individual organism under consideration to that exposure (dose-response) are modeled to generate an estimate of risk (hazard quotient) for each scenario. The herbicides in this analysis are compared based on the hazard quotient (HQ), which is the ratio between the estimated dose (the amount of herbicide received from a particular exposure scenario) and the reference dose (RfD). When a predicted dose is less than the RfD, then the HQ (estimated dose/RfD) is less than 1.0 and significant toxic effects are unlikely for that specific herbicide application. Table 3-49 displays scenarios in which HQs were exceeded.

Terrestrial and aquatic applications of herbicides are likely to alter vegetation and have secondary effects on terrestrial or aquatic animals including food availability and habitat quality.

Potential techniques to minimize wildlife exposures to herbicides include: selecting herbicides with low toxicity and using them at the lowest effective application rate to achieve the project's objective; using application methods that minimize off-target movement and non-target exposures; and using buffer areas for streams for certain herbicides. Treatments under all alternatives would be accomplished according to strict safety and health standards as required by EPA pesticide regulations which are listed as instructions for appropriate use on herbicide label.

Table 3-49: Exposure Scenarios in which Hazard Quotient Exceeded

Exposure Scenarios	2,4-D amine	Aminopyralid	Chlorsulfuron	Clopyralid	Dicamba	Glyphosate	Imazamox	Imazapic	Imazapyr	Metsulfuron-methyl	Picloram	Sulfometuron methyl	Triclopyr TEA
Acute													
Direct spray, honey bee	-	-	X	-	-	X	-	-	-	-	-	-	-
Direct spray, small mammal	X	-	-	-	-	-	-	-	-	-	-	-	-
Amphibians	-	*	-	-	-	-	*	*	*	*	*	-	*
Consume contaminated vegetation													
Large mammal	X	-	-	-	X	-	-	-	-	-	-	-	X
Small mammal	X	-	-	-	-	-	-	-	-	-	X	-	X
Bird	-	-	-	-	X	-	-	-	-	-	X	-	-
Consume contaminated water													

Exposure Scenarios	2,4-D amine	Aminopyralid	Chlorsulfuron	Clopyralid	Dicamba	Glyphosate	Imazamox	Imazapic	Imazapyr	Metsulfuron-methyl	Picloram	Sulfometuron methyl	Triclopyr TEA
Spill, small mammal	-	-	-	-	-	-	-	-	-	-	-	-	-
Consume contaminated insects													
Small mammal	X	-	-	-	X	-	-	-	-	-	-	-	-
Small bird	X	-	-	-	X	-	-	-	-	-	-	-	-
Consume contaminated prey													
Carnivore (small mammal)	X	-	-	-	-	-	-	-	-	-	-	-	-
Pred. bird (small mammal)	-	-	-	-	-	-	-	-	-	-	-	-	-
Pred. bird (fish)	-	-	-	-	-	-	-	-	-	-	-	-	-
Chronic													
Consume contaminated vegetation													
Large mammal	X	-	-	-	-	-	-	-	-	-	X	-	X
Small mammal	-	-	-	-	-	-	-	-	-	-	X	-	X
Bird	-	-	-	X	-	-	-	-	X	-	X	-	-
Consume contaminated water													
Small mammal	-	-	-	-	-	-	-	-	-	-	-	-	-
Consume contaminated insects													
Small mammal	-	-	-	-	-	-	-	-	-	-	-	-	-
Small bird	-	-	-	-	-	-	-	-	-	-	-	-	X
Consume contaminated prey													
Carnivore (small mammal)	-	-	-	-	-	-	-	-	-	-	-	-	-
Pred. bird (small mammal)	-	-	-	-	-	-	-	-	-	-	-	-	-
Pred. bird (fish)	-	-	-	-	-	-	-	-	-	-	-	-	-

*Limited or no data

2, 4-D

At the lowest application rate (0.5 lbs a.e./acre), the HQ marginally exceeded the LOC for small mammals eating contaminated insects (HQ= 1.4). At the typical application rate (1 lb a.e. /acre), hazard quotients exceed the LOC for four acute scenarios; small mammals eating contaminated insects (upper bound HQ=3), large mammals eating grass (upper bound HQ= 1.9), small mammals eating grass (upper bound HQ=1.7), and carnivorous mammals eating small mammals (HQ= 1.9); and one chronic scenario, large mammals eating contaminated vegetation (upper bound HQ= 1.4). At the highest anticipated application rate of 4 lb a.e./acre five acute scenarios have HQ that exceed the LOC; direct spray of a small mammal (HQ= 4), large mammals consuming contaminated grass (HQ= 2 to 8), small mammals eating contaminated grass (HQ= 2 to 7), small mammals eating contaminated insects (HQ= 4 to 11), and carnivorous mammals eating small mammals (HQ=8); and one chronic scenario of large mammals eating contaminated vegetation (upper bound HQ= 5). Dogs are the most sensitive to 2,4-D because of a limited ability to excrete organic acids. Doses that could

result in adverse effects to canids correlate to a HQ of 7 or greater. The potential for observing an adverse effect in other mammals is not well characterized (USDA Forest Service 2006).

Birds appear to be far less sensitive to 2,4-D than mammals. One acute exposure scenario, consumption of contaminated insects at an application rate of 4 lb a.e/acre results in in a HQ of 1.1. None of the chronic exposure scenarios resulted in a HQ that exceeded the level of concern. It is likely that risk estimates derived from gavage studies overestimate actual field exposure. For both birds and mammals, secondary effects may occur through changes to vegetation that may impact food availability and habitat (USDA Forest Service 2006).

For amphibians, no non-accidental exposures scenarios at any application rate resulted in HQ that exceeded a LOC. The EPA classifies 2,4-D acid/salts as practically non-toxic for amphibians. Accidental spills are a concern only for sensitive amphibian species (toad tadpoles). Chronic exposure data are not available (USDA Forest Service 2006).

Studies conducted on honeybees suggest that they will not be adversely affected by 2,4-D at any application rate. Other studies indicate that 2,4-D can adversely affect the growth and survival rate of other terrestrial invertebrates. The studies showed adverse effects generally occurred at concentrations or application rates greater than those used by the Forest Service, although effects are plausible at the application rate of 4 lb a.e./acre (USDA Forest Service 2006).

Some studies suggest that 2,4-D in combination with other herbicides may cause synergistic effects. One study implicated 2,4-D in combination with picloram may cause reproductive impairment in mice. There is no evidence that inert compounds or impurities found in 2,4-D formulations would have a significant health risk (USDA Forest Service 2006).

Aminopyralid

None of the acute of chronic scenarios for mammals or birds resulted in hazard quotients that exceeded a level of concern. For mammals, the HQs for all scenarios were below the LOC by factors of 14 to 100,000. The upper bounds of HQ for two acute scenarios were reached for large birds consuming contaminated grasses (0.6) and for small birds consuming contaminated insects (0.9). There is no indication that adverse effects to terrestrial invertebrates are likely. The very limited data on acute toxicity on amphibians indicate that leopard frog larvae are no more sensitive than fish (SERA 2007).

There is no information to suggest that specific sub-groups or individuals may be sensitive to this chemical. There is no data to assess if aminopyralid will interact with any other herbicide. The aminopyralid formulations reviewed in the risk assessment do not contain inerts other than water. Metabolites and impurities of aminopyralid have been determined to be of low concern and there is no basis for asserting that they are likely to result in effects additional to those analyzed under exposure scenarios (SERA 2007).

Chlorsulfuron

None of the acute or chronic scenarios for mammals or birds resulted in hazard quotients that exceeded a level of concern. There is no published literature regarding toxicity of chlorsulfuron to amphibians. There is very little published data regarding the effects of chlorsulfuron on terrestrial invertebrates (SERA 2004a). The chemical is identified as being slightly toxic (LD50 > 25µg/bee)

(USDOE BPA 2000a, EPA 1992). At the maximum application rate, the hazard quotient slightly exceeds the LOC (1.8) for honeybees. There is no basis to assert that direct spray would be likely to be lethal to insects or result in any adverse effects.

There is no data to assess if chlorsulfuron will interact synergistically or antagonistically with any other herbicide. No additives in formulations are classified as toxic. There is no indication that repeated exposure would exceed a toxicity threshold (SERA 2004a).

Clopyralid

Clopyralid is relatively non-toxic to terrestrial and aquatic animals. The only exposure scenario to slightly exceed the level of concern (1.3) is the consumption of contaminated vegetation for 90 days by a large bird at the maximum label application rate. This scenario is implausible because at that application rate the vegetation would die or be substantially damaged. This scenario is used as a very conservative upper estimate of potential exposure and risk. The available data is sufficient to assert that adverse effects in terrestrial animals are not likely to occur (SERA 2004b).

There is no data to assess if clopyralid will interact synergistically or antagonistically with any other herbicide. No additives in formulations are classified as toxic. There is no indication that repeated exposure would exceed a toxicity threshold (SERA 2004b).

Dicamba

At the typical application rate (0.3 lbs. a.e./acre), no exposure scenario results in an exceedance of a level of concern. No adverse effects are anticipated for birds or mammals at a typical application rate. At the maximum application rate of 2 lbs. a.e/acre, none of the chronic exposure scenarios had a hazard quotient the exceeded the level of concern. The level of concern was exceeded for acute exposure scenarios involving the consumption of vegetation for both large mammals (2) and birds (1.7) and the consumption of contaminated insects by small birds or mammals. Adverse effects to offspring, such as reduced hatchability and survival, could be plausible at the upper ranges of exposure associated with the maximum label application rate. Large mammals tend to be more sensitive to dicamba than small mammals. Dicamba is rapidly eliminated from the body by mammals. Dicamba is relatively non-toxic to amphibians (SERA 2004c).

There is no evidence that dicamba interacts with other compounds (SERA 2004c).

Glyphosate

None of the acute or chronic scenarios for mammals or birds resulted in hazard quotients that exceeded a level of concern. Aquatic applications pose no apparent risks to mammals or birds. Risks to terrestrial-phase amphibians would be characterized the same as risks to birds. There is no basis for asserting adverse effects to aquatic amphibians at the upper bound estimates of exposure at the maximum label application rate. Risks to amphibians and aquatic invertebrates are insubstantial (SERA 2011a).

For a direct spray on a honeybee scenario, the HQ would reach a level of concern (1) at the application rate of 3.3 lbs. a.e./acre. At the maximum application rate, the HQ would be 2.4. This would correlate to a dose that was found to have marginally significant mortality (3/60) which cannot exclude risks to honeybees being directly sprayed, but effects would likely not be substantial

or detectable. No exposure scenarios associated with spray drift exceeded the level of concern at any application rate. The HQ's were exceeded for the scenarios of consuming contaminated short grass (1.2) at the application rate of 1 lb a.e./acre; the consumption of broadleaf vegetation, small insects, and long grass at the applications rates of 1.4 and 1.7 lb a.e./acre; and at the maximum application rate of 8 lb a.e./acre, the HQ would exceed the LOC for the consumption of short grass (HQ=10), broadleaf vegetation and small insects (HQ=6) and long grass (HQ=5). The use of toxicity data on honeybees as a surrogate for other terrestrial invertebrates adds uncertainty. Recent studies and hazard quotient data identify concerns that more toxic formulations of glyphosate could have an adverse impact on some terrestrial invertebrates. The extent to which these studies are relevant to the less toxic US formulations (those used by the Forest Service) is not certain (SERA 2011a).

Glyphosate breaks down into a metabolite and impurities. The metabolite present in the formulations used by the Forest Service is aminomethyl phosphonate (AMPA). Mammalian exposures to this metabolite are encompassed in existing glyphosate toxicity data. As far as it being an environmental metabolite, it has been determined that AMPA is not of toxicological concern by the EPA. Glyphosate contains NNG (N-nitrosoglyphosate) as an impurity. The EPA has concluded that the NNG content present in glyphosate is not toxicologically significant (SERA 2011a).

Glyphosate inhibits some cytochrome P450 isozymes (aromatase). The inhibition of these enzymes could enhance or diminish the toxicity of other compounds dependent on whether metabolism increases or decreases toxicity of those compounds (SERA 2011a).

The impact of an added surfactant for aquatic applications is directly proportional to the surfactant's toxicity and concentration. Use of lower application rates while keeping the concentration of the surfactant constant would decrease the impact of the surfactant relative to high application volumes (SERA 2011a).

Imazapic

None of the acute or chronic scenarios for mammals or birds resulted in hazard quotients that exceeded a level of concern. There is a lack of data regarding the effects of imazamox on terrestrial and aquatic-phase amphibians. There is no basis for asserting that they may be a risk from exposure of Imazamox based on the risk characterization for fish and all other groups of aquatic and terrestrial animals. The upper bound HQ for consumption of contaminated short grass by a terrestrial invertebrate is 1.1, which has been identified as essentially negligible in the risk assessment. Imazamox appears to be essentially non-toxic to terrestrial and aquatic animals (SERA 2010).

The low HQs associated with the non-accidental exposure scenarios, there does not appear to be a plausible basis for suggesting that inerts, impurities, or metabolites will have an impact on the risk characterization for potential effects. The use of relatively toxic nonionic surfactants in aquatic applications may pose a greater risk to aquatic animals than exposure to imazamox alone. However, even the theoretical use of a very toxic surfactant in aquatic applications would result in concentration levels that would have exposures below the EPAs LOC for endangered species by a factor of five. There is no basis for inferring toxicological interactions of imazamox with other agents (SERA 2010).

Imazapyr

Imazapyr is practically non-toxic to mammals, birds, fish, and terrestrial invertebrates. All exposure scenarios had HQ below the LOC for mammals. One exposure scenario for birds, chronic consumption of contaminated grass, had a HQ of 1.4 which modestly exceeds the LOC. Anticipated exposure levels to birds and mammals from aquatic applications are expected to be far lower than those associated with terrestrial applications. There is no basis to assert that signs of toxicity would be observed in mammals, birds, or aquatic animals after exposure to imazapyr.

No toxicity studies were identified as being conducted on the effects of imazapyr on amphibians in the risk assessment. The EPA used toxicity values for fish in the risk characterization for aquatic phase amphibians (SERA 2011). A study conducted that found no overt toxic effects to Oregon spotted frogs from imazapyr tank mixes; no differences in growth, liver condition index, or body condition index; and no differences in behavior when exposed to imazapyr (Yahnke et al. 2013).

The low HQs associated with the non-accidental exposure scenarios, there does not appear to be a plausible basis for suggesting that inerts, impurities, or metabolites will have an impact on the risk characterization for potential effects. The use of relatively toxic nonionic surfactants in aquatic applications may pose a greater risk to aquatic animals than exposure to imazapyr alone. However, even the theoretical use of a very toxic surfactant in aquatic applications would result in concentration levels that would have exposures below the EPAs LOC for endangered species by a factor of five. There is no basis for inferring toxicological interactions of imazapyr with other agents (SERA 2011b).

Metsulfuron Methyl

None of the acute or chronic exposure scenarios at any application rate for mammals, birds, terrestrial invertebrates, resulted in a HQ that exceeded the LOC. Metsulfuron methyl is tested on certain species under controlled conditions, which may not well-represent free-ranging wildlife. However, available data are sufficient to assert that no adverse effects are anticipated for terrestrial mammals or birds (SERA 2004e).

A study conducted on common toad tadpoles showed that picloram had some evidence of genotoxic (harmful to genetic material) potential and that mixture of glyphosate and picloram had synergistic effects. However, the glyphosate in the study contained POAE (polyethoxylated tallow amine), which is toxic to amphibians (Lajmanovich et al. 2013). POAE is not proposed for use in the SCNF.

There are no data to suggest that metsulfuron methyl would interact synergistically or antagonistically with any other herbicide proposed for use. Toxicity of metabolites is encompassed in available mammalian toxicity studies (SERA 2004e).

Picloram

One of the acute accidental exposure scenarios for mammals, consumption of short contaminated grass by a small mammal, has an upper bound HQ of 3. Chronic exposure scenarios that involve the consumption of contaminated grasses result in HQs that exceed the LOC (small mammal= 12, 400 g mammal= 3, and large mammal= 1.5). A study in rats determined that the LOAEL (lowest observed adverse effect level), corresponded to an HQ of 3. The toxicological significance of the HQs of 1.5

and 3 appear to be questionable or at least relatively modest. Obvious signs of toxicity would not be expected at a chronic HQ of 3. The HQ of 12 for a small mammal is above several sub-chronic LOAEL, none of which was associated with evident signs of toxicity. Secondary effects to mammals based on toxic effects to invertebrates does not seem likely, but cannot be ruled out. Other secondary effects are associated with potential decreases in food supplies rather than direct toxic effects of picloram.

Two exposure scenarios or birds exceeded HQ level of concern. In an acute scenario, a small bird eating contaminated grasses resulted in an upper bound HQ of 1.1, which is modest enough of an exceedance of the HQ that it can be dismissed. The chronic exposure scenario of a small bird eating contaminated grass has an upper bound HQ of 9. The scenario corresponds with an estimated daily dose that is more than four times the LOAEL. A reservation with the scenario is that although some species of small birds may eat grass; it is generally not a major portion of the diet. The upper bound HQ of 9 may be interpreted that for chronic exposure, adverse effects in some, especially young, birds may not be ruled out; however prevalence and severity of effects cannot be characterized. No toxicity studies have been conducted on the effects of picloram on amphibians (SERA 2011c).

A study conducted on common toad tadpoles showed that picloram had some evidence of genotoxic potential and that mixture of glyphosate and picloram had synergystic effects. However, the glyphosate in the study contained POAE (polyethoxylated tallow amine), which is toxic to amphibians (Lajmanovich et al. 2013). POAE is not proposed for use in the SCNF.

Exposure scenarios for honeybees or herbivorous insects do not exceed a HQ level of concern (SERA 2011c).

There is no information to suggest that specific sub-groups or individuals may be sensitive to this chemical. One study implicated 2,4-D in combination with picloram may cause reproductive impairment in mice. A study indicates that a commercial mixture of picloram and 2,4-D may impact immune function in rats; however, the study does not allow for an evaluation of any potential interactions between picloram and 2,4-D (SERA 2011c).

Sulfometuron Methyl

None of the acute or chronic exposure scenarios at any application rate for mammals, birds, amphibians, or terrestrial invertebrates, resulted in a HQ that exceeded the LOC. Although sulfometuron methyl has only been tested on a limited number of species under controlled conditions, it is believed that the available data are sufficient to assert that no adverse effects would be anticipated from the use of sulfometuron methyl (SERA 2004f).

There is no evidence that sulfometuron methyl would interact synergistically or antagonistically with any other herbicide (SERA 2004f).

Triclopyr

The HQs for mammals increase as body weight increases. Both acute and chronic exposure scenarios for large and small mammals eating contaminated vegetation had HQs that exceeded the LOC at an application rate of 1 lb a.e./acre. Based upon HQs that exceed LOC, the greatest risk would be to large mammals eating contaminated vegetation over a long time period (central estimate HQ=5, range of 0.2 to 53), followed by acute exposures for large mammals (central

estimate HQ=2, range of 0.2 to 11), chronic exposures for small mammals (central estimate HQ=0.7, range of 0.03 to 7), and acute exposures for small mammals (central estimate HQ=0.3, range of 0.02 to 1.6). Data suggest that HQs of about 4 could be related to adverse effects such as changes in blood chemistry or birth defects. Overt signs of toxicity would not likely be observed. The hazard quotients developed in risk assessments suggest that adverse effects could occur to mammalian wildlife at application rates generally used by the Forest Service. The exposure scenario is designed to be extreme; the assumption is that 100% of the diet would be contaminated, which would not realistically occur. Risks to mammals associated with aquatic application are minimal. The consumption of treated emergent vegetation could be analogous to the consumption of treated terrestrial vegetation (SERA 2011d).

The exposure scenario of a small bird consuming contaminated insects results in a modest exceedance of the upper bound HQ of 0.3 (range of 0.02 to 1.8). The HQs are based on residue rates that are equivalent to rates used for broadleaf vegetation. Other HQs that approach a LOC for birds are exposure scenarios that are associated with the chronic consumption of contaminated vegetation. Avian field studies are not as numerous or detailed as those for mammals and do not confirm or refute toxicity concerns based on HQs (SERA 2011d).

No toxicity data is available for terrestrial phase amphibians. None of the exposure scenarios resulted in a HQ that exceeded the LOC for terrestrial invertebrates. Aquatic applications of triclopyr do not lead the HQs that exceed levels of concern for fish, amphibians, and aquatic invertebrates (SERA 2011d). A study conducted on African clawed frogs (*Xenopus laevis*) found that the maximum label application rates of the amine formulation of triclopyr applied during 96 hour embryo development did not result in a toxic response. Triclopyr dissipates quickly in water (Perkins et al. 2000).

A major metabolite of triclopyr is 3,5,6-trichloro-2-pyridinol (TCP) which is toxic to mammals and other species. TCP is more toxic than triclopyr is to some aquatic organisms. The EPA does not consider TCP to be an agent of toxicological concern. No data allows for an assessment of species sensitivity to TCP for mammals, so risks to all mammals are characterized the same. Relatively little data is available for birds. There is no information in toxicity literature relating to amphibians and TCP (SERA 2011d).

Drift and Volatilization

Herbicides can move through the atmosphere through spray drift, which occurs during herbicide application, and volatilization, which occurs after application. Volatility is dependent on the physical properties of the herbicide, primarily vapor pressure, while spray drift is dependent on the sprayer parameters such as nozzle orifice size, boom height and pressure, and wind speed (Branham and Hanson 1987).

Volatilization is the conversion a liquid or solid chemical to a gas. The amount of volatilization that occurs is dependent upon climactic and microclimatic conditions. Soil moisture is the primary environmental condition that influences the rate at which herbicides volatilize; in general, herbicides volatilize more rapidly from moist soils than dry soils (Menalled and Dyer 2005). Volatilization also increases with higher air and soil temperatures and increasing wind speed. The use of surfactants can change the volatility of an herbicide (Lincoln Co. unk.). Ester formulations of

herbicides have higher vapor pressures and volatilize more than amine formulations (Nice et al. 2004). No ester formulations are proposed for use in this analysis.

Spray drift is the movement of the herbicide, generally via spray droplets, from the target area to an unintended area. Spray drift can be reduced by increasing droplet size. This can be done by reducing spray pressure, increasing nozzle orifice size, using drift reduction nozzles, rearward nozzle orientation during aerial applications, and the addition of adjuvants to the mixture. Other factors that influence spray drift are the method of application- drift is generally greater from mist blower and aerial applications than ground application; the distance between the nozzle and target(less distance will reduce drift); wind direction and wind speed; air stability; and temperature and humidity (low humidity and high temperatures causes rapid evaporation, which reduces the size of droplets). The influence of humidity and temperature is not always predictable, however (Dexter 1993).

Spray drift cannot be completely eliminated; however, with proper management, drift levels can be minimized to levels that do not cause harm (Felsot 2001). The methods to reduce drift potentials of herbicides considered for aerial application are discussed below.

Aminopyralid

For aerial applications, liquid formulations of aminopyralid are applied through specially designed spray nozzles and booms that are designed to reduce turbulence and maintain large droplet size to reduce drift (SERA 2007). Applications may only be done under favorable weather conditions, which include wind speeds between 2 and 10 mph and not during temperature inversions (Dow AgroScience 2012). It should be applied at rates of no less than two gallons (mixed) per acre; five gallons or greater are recommended (Dow AgroScience 2012). If electrostatic spray systems are used, then it can be applied at a rate of one gallon per acre (Dow AgroScience 2007).

Chlorsulfuron

Chlorsulfuron may be applied aerially to range and pasture land at a minimum of three GPA (gallons per acre). Approximately 40 to 100 acres per hour may be treated. The most effective way to reduce spray drift is to apply large droplets that provide sufficient coverage and control. When applying by air in areas adjacent to sensitive non-target plants, solid stream nozzles oriented straight back should be used. To reduce the potential for drift, applications should not be made in windy or gusty conditions (applications should occur when wind speeds are less than 3 mph or more than 10 mph) or during temperature inversions and helicopter boom length must not exceed 90% of rotor blade diameter. Ideally, application should be made no more than 10 feet above canopy unless a greater height is required for helicopter safety (DuPont 2011).

Clopyralid

Clopyralid has been shown to have little potential for drift during aerial applications (DiTomaso et al. 2004). To reduce any possible drift, the label recommends using straight stream nozzles, use spray booms no longer than ¾ of rotor length, utilize drift control systems and drift control additives. Aerial applications should be conducted when wind velocity is low and not applied during temperature inversions (Dow AgroScience 2011a).

Imazapic

Aerial applications for Imazapic are to be conducted only by helicopter for Forest Service purposes. Approximately 40 to 100 acres per hour may be treated. Liquid formulations are applied through

specially designed spray nozzles and booms that are designed to reduce turbulence and maintain large droplet size to reduce drift (SERA 2004d). To reduce or prevent drift, applications should not be made in windy or gusty conditions (applications should occur when wind speeds are between 3 and 10 mph), high temperatures, low humidity, or temperature inversions (BASF 2011).

Metsulfuron methyl

Metsulfuron methyl may be applied aerially to range and pasture land at a minimum of three GPA (gallons per acre). The most effective way to reduce spray drift is to apply large droplets (150 microns or larger) that provide sufficient coverage and control. When applying by air in areas adjacent to sensitive non-target plants, solid stream nozzles oriented straight back should be used. To reduce the potential for drift, applications should not be made in windy or gusty conditions (applications should occur when wind speeds are less than 3 mph or more than 10 mph) or during temperature inversions and helicopter boom length must not exceed 90% of rotor blade diameter. Ideally, application should be made no more than 10 feet above canopy unless a greater height is required for helicopter safety (DuPont 2009).

Picloram

Aerial applications for Picloram are to be conducted only by helicopter for Forest Service purposes. Approximately 40 to 100 acres per hour may be treated. Liquid formulations are applied through specially designed spray nozzles and booms that are designed to reduce that are designed to reduce turbulence and maintain large droplet size to reduce drift (SERA 2011c).Sulfometuron methyl

Sulfometuron methyl may be applied aerially to public and private lands to treat certain invasive plant species that have been determined to be invasive. The most effective way to reduce spray drift is to apply large droplets (150 microns or larger) that provide sufficient coverage and control. When applying by air in areas adjacent to sensitive non-target plants, solid stream nozzles oriented straight back should be used. To reduce the potential for drift, applications should not be made in windy or gusty conditions (applications should occur when wind speeds are less than 3 mph or more than 10 mph) or during temperature inversions and helicopter boom length and position must prevent droplets from entering rotor vortices. Ideally, application should be made no more than 10 feet above canopy unless a greater height is required for helicopter safety. This herbicide may only be applied when the potential for drift to adjacent sensitive areas (e.g. residential areas, water bodies, known T/E habitat) is minimal (DuPont 2009).

Other Ingredients and Adjuvants

Inert (or other) ingredients and adjuvants are ingredients in an herbicide formulation other than the active ingredient. By law, the active ingredient must be identified on a product's label and the percentage by weight disclosed. Inert ingredients and adjuvants are substances that are intentionally added to an herbicide either in the commercial formulation or in the tank mixture. Their purpose is to influence the effectiveness of the active ingredient by doing such things as preventing caking or foaming, extending shelf-life, acting as surfactants, or assisting with the mixing and/or application of the herbicide. It is not required by law to disclose the name or percentage of the ingredients on the label or MSDS sheet, because the identity is considered proprietary information of the manufacturer (EPA 2012b).

Some formulations of glyphosate contain the surfactant polyethoxylated tallow amine (POAE). The toxicity of formulations which contain the surfactant is greater than the toxicity of formulations

which do not contain it. The SCNF does not propose to use the formulations of glyphosate which contain the POAE surfactant.

The EPA reviews the inert ingredients prior to registration. The lack of disclosure on the label of other ingredients in a formulation indicates that none of the inert ingredients present at a concentration of 0.1% or greater are classified as hazardous or toxic (SERA 2004a). The inclusion of certain ingredients in adjuvant formulations is regulated by the EPA, but the testing, the oversight of manufacture, and the use of adjuvants is not regulated consistently.

During the preparation of the SERA risk assessments, data on inert ingredients that was in the confidential business information (CBI) files or obtained under a FOIA request was reviewed. The exception was for 2,4-D, whose study predates FOIA availability (USDA Forest Service 2006). The herbicide formulations that had proprietary information released included inert ingredients that are on the EPA Inert List 4A: minimal risk ingredients (low toxicity or non-toxic); List 4B: other ingredients for which EPA has sufficient information to reasonably conclude that the current use will not adversely affect public health; or List 3: inert ingredients for which available toxicology data are insufficient to classify the compound as of toxicologic concern (List 1), possible toxicologic concern (List 2), or of minimal concern (List 4). No toxic substances were identified as being included in herbicide formulations.

The list of adjuvants commonly used in the SCNF is identified in Appendix D.

General Effects to Wildlife

Many new herbicides (ALS inhibitors for example) are 100 times more toxic to select plant species than their predecessors and are applied a rates 100 times lower. The concentration levels of these herbicides are so low as to not be detectable by standard chemical detection protocols. The poundage of herbicides has decreased, but the number of treated acres has not. A thorough assessment of potential exposure to herbicides by wildlife is not possible due to lack of production and usage data (Colborn and Short 1999).

Literature that describes the effects of herbicides on birds generally focuses on habitat alteration. Studies that looked at the aerial application of glyphosate to control brush found that the treatments resulted in vegetation that was structurally less complex and a reduction in abundance of invertebrates. Birds that used shrub habitat for foraging and nesting declined in abundance post-treatment, more so than species that tended to be habitat generalists (Morrison and Meslow 1984, Santillo et al. 1989). Once the vegetation recovered from the herbicide treatment, bird abundance increased (Morrison and Meslow 1984). The use of selective herbicide in shrub habitats did not affect nesting success of population density (Marshall and Vandruff 2002).

Small mammal response to herbicide treatments is species specific; some are unaffected, some select treated areas, some avoid treated areas (Lautenschlager 1993; Santillo et al 1989b). Animal response to herbicide treatments, if they occur, were found to be species specific, linked to treatment related habitat changes, and short in duration- limited to one to a few years post-treatment. Studies suggest that broadcast herbicide treatments do not result in broad-scale reductions in plant or animal species richness or animal populations (Lautenschlager and Sullivan 2004). The species richness and diversity of vascular plants were found to be either unaffected or increased in response to treatment with glyphosate. Species richness and diversity of songbirds and

small mammals were little affected by herbicide-induced habitat alteration (Sullivan and Sullivan 2003).

The use of glyphosate to manage vegetation temporarily reduce the relative abundance of forb and shrub species, but resulted in either short-term or no change in the abundance in large mammalian herbivores in the study area (Sullivan and Sullivan 2003). Elk were found to forage almost exclusively in a historically cultivated grass field after knapweed removal, as compared to an area that did not have knapweed removed (Thompson 1996).

A study that looked at picloram effects on balsamroot found that the herbicide did not change the leaf area, but reduced flowering and seed set for up to four years after application. Balsamroot slowly declines in the presence of invasive plants and rapidly declines in the presence of herbicide, but may experience a period of increase after the herbicide decays and invasive plants are suppressed. The beneficial or detrimental effects of herbicide treatment are based on how often site is sprayed and how long the herbicide persists in the soil. It is important to combine invasive plant management techniques and time treatments appropriately. Herbicide use in natural areas differs from agricultural treatments because non-target species are not under direct management control (Crone et al. 2011).

Effects of herbicide treatments used for forest vegetation management have generally been found to have no toxicological and minimal or short-term effects on biota (Lautenschlager and Sullivan 2004). The use of glyphosate in forested areas resulted in little or no direct effects on the metabolic or general physiological processes in the development of young animals (Sullivan 1990). A study that looked at imazapyr effects on macroinvertebrates in isolated surface water areas that collect run-off found no statistical difference in macroinvertebrates community composition, deformity rate, and biomass amount and suggested that there were no effects at the concentrations tested (Fowlkes et al. 2003).

Amphibians do not appear to be affected, either through direct toxicity or changes in food or habitat availability, by 2,4-D. The Roundup formulation of glyphosate (which contains the POEA surfactant) was found to be toxic to tadpoles, although there was no apparent effect to the algal food source (Relyea 2005). No alternative considers the use of glyphosate with POEA surfactant. Laval toads were found to have a high tolerance to clopyralid when tested in laboratory conditions (DiTomaso et al. 2004).

Potential Effects from Rehabilitation and Restoration Treatments

Seed sources and vegetation used for the restoration or reclamation of sites infested with invasive plants would follow the guidance found in FSM 2070- vegetation ecology. Equipment that could be used during reseeding activities includes, but is not limited to, hand tools such as rakes or larger equipment such OHV-drawn harrows. Ground disturbance would be minimized as much as possible during reseeding activates. Effects to wildlife from seeding activities would be similar to those for manual and mechanical treatments.

These treatments could result in bare ground and soil disturbance, albeit in a relatively small areas and for a short duration. Non-target species (generally plants) could be trampled.

Mechanical treatment methods tend to be loud, especially in comparison to other treatment methods. This could disturb secretive animals and species sensitive to noise, causing them to leave

the project area for at least the duration of the treatment, which would tend to be sort-term (generally no more than a few consecutive days).

Mechanical disturbance associated with interseeding in a Wyoming big sage community for that the disturbance did not impact small mammal populations in terms of species richness, abundance, diversity or similarity, and appeared to result in stable or increased populations post-treatment (Borchgrevink et al. 2010).

Some mechanical equipment, such as harrows, could potentially crush less mobile animals or nests. The nature of the treatment is to improve cover, but would take at least one growing season for results to appear.

3.5.7.2. Alternative 2-Current Action

Direct and Indirect Effects

Federally Listed or Candidate Species

Yellow-billed Cuckoo

There have been no documented occurrences of yellow-billed cuckoos on the Salmon-Challis National Forest. There are 3,150 acres of currently identified invasive plant infestations in the approximately 36,000 acres of riparian cover type (Table 3-3). Six of the herbicides proposed for use in riparian areas had no exposure scenarios that exceed a hazard quotient for birds. Two, clopyralid and imazapyr, had scenarios that had hazard quotients that exceeded levels of concern for birds consuming vegetation of a long period of time. That would not apply to cuckoos, since they are primarily insectivorous. One herbicide, triclopyr, did have a modest exceedance of the upper bound HQ of 0.3 (range of 0.02 to 1.8) for the scenario of a small bird consuming contaminated insects.

Deciduous trees and shrubs, which are an important habitat component for this species, are largely tolerant of the herbicides proposed for use in riparian areas at application rates used for forbs. Injury, such as leaf cupping or curling, chlorosis, and/or potential defoliation, as well as injury or mortality for seedlings could occur. Deciduous woody species are more susceptible to injury or death from two herbicides, imazapyr and sulfometuron methyl. There would be no broadcast application in riparian areas, and no applications would occur if sustained wind speeds exceed 5 mph or label directions in order to prevent drift and damage to non-target riparian plant species (Appendix J).

Effects Determination

Direct effects to yellow-billed cuckoos as result of herbicide toxicity are unlikely. The one herbicide, triclopyr, which had a scenario of birds consuming contaminated insects that slightly exceeded the upper bound HQ, is an herbicide that is rarely used (Table 3-49). The anticipated low use of the herbicide combined with the lack of sightings of the species and very little potential habitat, decreases the possibility of effects.

Indirect effects from habitat alteration are also expected to be negligible. Of the nine herbicides that are proposed for use in riparian areas, deciduous woody species are susceptible to two of them. Applications would be targeted, since no broadcast application would occur in riparian areas, so

non-target species damage would be expected to be minimal. Tamarisk, which has been identified as being detrimental to yellow-billed cuckoos, would be a target species.

No effects are expected to as a result of biological or manual/mechanized treatment methods or cultural restoration activities.

The implementation of the Current Action may affect, but is not likely to adversely, and may beneficially affect yellow-billed cuckoos.

Canada Lynx

There are approximately 1,140 acres of currently identified invasive plant infestations within 391,194 acres of lynx analysis units (LAUs) which is equivalent to 0.003% of the LAU area (Appendix P). Noxious weeds are not identified as a risk factor for lynx or lynx habitat in the Northern Rockies Lynx Management Direction (USDA Forest Service 2007). There are no specific objectives, standards, or guidelines that speak to invasive plant management.

Of the 10 herbicides proposed for use in upland areas, one, 2,4-D, has an exposure scenario that exceeds a hazard quotient level of concern for carnivores. The assumption regarding the consumption of small mammals by predatory mammals was that the small prey mammal was directly sprayed with 100% absorption. At the typical application rate of 2,4-D (1 lb a.e/acre), hazard quotients exceed the LOC for the acute scenario of carnivorous mammals eating small mammals (HQ= 1.9). At the highest anticipated application rate of 4 lb a.e./acre this scenario exceed the LOC (HQ=8) (USDA Forest Service 2006).

Of the 1,077 identified infested acres, 1,055 acres (93%) are spotted knapweed. Lynx habitat predominantly consists of two structurally different forest types: early successional forests which contain higher numbers of prey, and late-successional forests which provide cover for denning and kittens. Conifers are largely tolerant of the recommended herbicides for use on spotted knapweed (Table 3-41) at typical application rates. Common injuries to conifers include chlorosis, needle shed, needle curl, and branch die-back. Picloram can result in root uptake if applied within the drip line (Appendix I).

Effects Determination

Direct effects to Canada lynx as a result of herbicide toxicity are unlikely. The combination of the small number of infested acres within the LAUs, the improbability of the exposure scenario (it is not likely that a snowshoe hare would be directly sprayed by 2,4-D then preyed upon by a lynx), and the low number of observations of lynx in the SCNF, decreases the possibility of effects.

Indirect effects as a result of habitat alteration from herbicide applications are not likely. The number of currently known infested acres comprises 0.003% of LAUs within the proposed action area. Conifers are largely tolerant of the herbicides proposed for ground-based application. Indirect effects as a result of improvement of prey habitat from all invasive plant treatment methods are likely to be beneficial.

The Current Action alternative may affect, but is not likely to adversely, and may beneficially affect Canada lynx.

Region 4 Sensitive Species

Gray Wolf

Wolves are present on all Ranger Districts, therefore all invasive plant management zones. They are also habitat generalists, so they could presumably utilize every cover type. Of the 3.1 million acres of all mapped cover types in the action area, there are 49,135 acres of identified noxious weed infestations (Appendix P).

Of the ten herbicides that are being analyzed for use, one, 2,4-D, had a HQ that exceeded the level of concern for the scenario of carnivores consuming contaminated prey at both the typical (HQ=1.9) and maximum (HQ=8) application rates. The exposure scenario made the assumption that the small prey mammal consumed by the predatory mammal was directly sprayed with 100% absorption. Canids are sensitive to 2,4-D because they have a limited ability to excrete organic acids. Doses that could result in adverse effects correlate to an HQ greater than 7.

The diet of wolves is largely comprised of ungulates, so prey availability is very important to the stability of wolf populations. The treatment methods- herbicide, manual and mechanical, biological, and restoration activities- are expected to have a long-term beneficial effect on overall forage quality and quantity (see Elk discussion below).

Effects Determination

Direct effects to wolves as a result of herbicide toxicity are unlikely. The combination of the small number of infested acres within the proposed action area and the improbability of the exposure scenario (it is not likely that a prey species would be directly sprayed by 2,4-D then preyed upon by a wolf) decreases the possibility of effects.

Indirect effects as a result of prey availability from all invasive plant treatment methods are likely to be beneficial. Overall, the treatment methods would positively influence forage for key prey species such as elk, which would result in a potential improvement in the prey base.

The Current Action alternative may impact individual wolves, likely in a beneficial manner, but would not likely contribute to a trend towards Federal listing.

Wolverine

There are approximately 2,000 acres of currently identified infestations within the 758,000 acres of modeled wolverine habitat. Of the identified infested acres, 60% are spotted knapweed, 24% are Canada thistle, and 12% are musk thistle (Appendix P).

Of the 10 herbicides proposed for use in upland areas, one, 2,4-D, has an exposure scenario that exceeds a hazard quotient level of concern for carnivores. The assumption regarding the consumption of small mammals by predatory mammals was that the small prey mammal was directly sprayed with 100% absorption. At the typical application rate of 2,4-D (1 lb a.e. /acre), hazard quotients exceed the LOC for the acute scenario of carnivorous mammals eating small mammals (HQ= 1.9). At the highest anticipated application rate of 4 lb a.e./acre this scenario exceed the LOC (HQ=8) (USDA Forest Service 2006).

Wolverine habitat predominantly consists of high elevation conifer forests. Conifers are largely tolerant of the recommended herbicides for use on spotted knapweed and Canada thistle typical

application rates. Common injuries to conifers include chlorosis, needle shed, needle curl, and branch die-back. Dicamba and picloram can result in root uptake if applied within the dripline (Appendix I).

Effects Determination

Direct effects to wolverine as a result of herbicide toxicity are unlikely. The combination of the small number of infested acres within modeled potential habitat and the improbability of the exposure scenario (it is not likely that a prey species would be directly sprayed by 2,4-D then preyed upon by a wolverine) decreases the possibility of effects.

Indirect effects as a result of habitat alteration from herbicide applications are not likely. The number of currently known infested acres comprises 0.003% of modeled wolverine habitat within the proposed action area. Conifers are largely tolerant of the herbicides proposed for both ground-based and aerial application (Appendix I).

Indirect effects as a result of prey availability from all invasive plant treatment methods are likely to be beneficial. Overall, the treatment methods would positively influence forage for key prey species such as elk, which would result in a potential improvement in the prey base.

The Current Action alternative may impact individual wolverines, likely in a beneficial manner, but would not likely contribute to a trend towards Federal listing.

Fisher

Fisher habitat has not been modeled in the SCNF. Although they have not been observed on all Districts, therefore all Invasive Plant Management Zones, lack of detection does not prove absence or presence. Utilizing the cover types of conifer and riparian across the analysis area, there are approximately 3,150 acres of known infestations within the approximately 36,000 acres of riparian cover type (Appendix P)and approximately 25,600 acres of known infestations within the approximately 1.7 million acres of conifer cover type (Appendix P). Of the known invasive plant infestations in these cover types, the top three are knapweed (83%), musk thistle (5%), and Canada thistle (4%).

Of the ten herbicides proposed for use, one, 2,4-D, has an exposure scenario that exceeds a hazard quotient level of concern for carnivores. The assumption regarding the consumption of small mammals by predatory mammals was that the small prey mammal was directly sprayed with 100% absorption. At the typical application rate of 2,4-D (1 lb a.e per/acre), hazard quotients exceed the LOC for the acute scenario of carnivorous mammals eating small mammals (HQ= 1.9). At the highest anticipated application rate of 4 lb a.e./acre this scenario exceed the LOC (HQ=8) (USDA Forest Service 2006).

Fisher habitat predominantly consists of conifer forests and forested riparian areas. Conifers are largely tolerant of the proposed herbicides at typical application rates. Common injuries to conifers include chlorosis, needle shed, needle curl, and branch die-back. Dicamba, and picloram can result in root uptake if applied within the dripline. Seedlings are susceptible to injury from application of 2,4-D (Appendix I).

There would be no broadcast application in riparian areas, and no applications would occur if sustained wind speeds exceed 5 mph or label directions in order to prevent drift and damage to non-target riparian plant species.

Effects Determination

Direct effects to fisher as a result of herbicide toxicity are unlikely. The combination of the small number of infested acres within modeled potential habitat and the improbability of the exposure scenario (it is not likely that a prey species would be directly sprayed by 2,4-D then preyed upon by a fisher) coupled with the very low number of occurrences of fisher in the SCNF decreases the possibility of effects.

Indirect effects as a result of habitat alteration from herbicide applications are not likely. The number of currently known infested acres comprises 0.09% of riparian cover type and 0.02% of conifer cover type within the proposed action area. Conifers are largely tolerant of the herbicides proposed.

Indirect effects as a result of prey availability from all invasive plant treatment methods are likely to be beneficial. Overall, the treatment methods would positively influence forage for key prey species, which would result in a potential improvement in the prey base.

The Current Action alternative may impact individual fisher, likely in a beneficial manner, but would not likely contribute to a trend towards Federal listing.

Bighorn Sheep

There are 1,940,796 acres of modeled bighorn sheep habitat within the proposed action area. Within those modeled habitat acres, there are 28,095 acres of known weed infestations, the majority of which (78%) are spotted knapweed, with the next most common being hoary alyssum (6%) and Canada thistle (6%) (Appendix P).

Of the ten herbicides that are being analyzed for use, four had hazard quotients (HQs) that exceeded the level of concern (LOC) for the scenario of large mammals consuming contaminated vegetation. Three herbicides, 2,4-D, dicamba, and triclopyr, had acute scenarios that had HQs that exceeded levels of concern, and three, 2,4-D, picloram, and triclopyr, had chronic scenarios that had HQs that exceeded levels of concern.

At the typical application rate of 2, 4-D, (1 lb a.e. /acre), hazard quotients exceed the LOC for the acute (upper bound HQ= 1.9) and chronic (upper bound HQ= 1.4) scenarios of large mammals eating contaminated vegetation. At the highest anticipated application rate of 4 lb a.e./acre, hazard quotients exceed the LOC for the acute (HQ= 2 to 8) and chronic (upper bound HQ= 5) scenarios of large mammals eating contaminated vegetation.

At the typical application rate for dicamba, no exposure scenario results in an exceedance of a level of concern. No adverse effects are anticipated for mammals at a typical application rate. At the maximum application rate (2 lb a.e./acre), the level of concern was exceeded for acute exposure scenario involving the consumption of vegetation for both large mammals (HQ= 2). Adverse effects to offspring, such as reduced survival, could be plausible at the upper ranges of exposure associated with the maximum application rate. Large mammals tend to be more sensitive to dicamba than small mammals. Dicamba is rapidly eliminated from the body by mammals.

At the maximum application rate of 1 lb a.e./acres of picloram, the chronic exposure scenario of the consumption of contaminated grasses result in HQs that exceed the level of concern for large mammals (HQ= 1.5). A study in rats determined that the LOAEL (lowest observed adverse effect level), corresponded to an HQ of 3. The toxicological significance of the HQs of 1.5 and 3 appear to be questionable or at least relatively modest. Obvious signs of toxicity would not be expected at a chronic HQ of 3. Secondary effects are associated with potential decreases in food supplies rather than direct toxic effects of picloram.

For triclopyr, the HQs for mammals increase as body weight increases. Both acute and chronic exposure scenarios for large mammals eating contaminated vegetation had HQs that exceeded the LOC at an application rate of 1 lb a.e./acre. Based upon HQs that exceed LOC, the greatest risk would be to large mammals eating contaminated vegetation over a long time period (upper bound HQ=5, range of 0.2 to 53). Data suggest that HQs of about 4 could be related to adverse effects such as changes in blood chemistry or birth defects. Overt signs of toxicity would not likely be observed. The hazard quotients developed in risk assessments suggest that adverse effects could occur to mammalian wildlife at application rates generally used by the Forest Service. The exposure scenario is designed to be extreme; the assumption is that 100% of the diet would be contaminated, which would not realistically occur.

From a forage perspective, grasses and forbs, and to a lesser degree, shrubs are very important to bighorn sheep. Perennial grasses, once they are past the seedling stage, are largely tolerant of the ten herbicides being analyzed. Some herbicides, such as metsulfuron methyl, are used to control annual grasses. Most families of forbs are susceptible. Shrubs are prone to seedling mortality and injury from foliar applications.

Since most of the target species are forbs, it is reasonable to expect that forbs are susceptible to herbicide application. Most forbs are tolerant to metsulfuron methyl, since it is used to target annual grasses. Clopyralid targets the aster/composite, legume/pea, knotweed, and nightshade families; chlorsulfuron and sulfometuron methyl target the borage, mustard/crucifer, and legume/pea families; and imazapic targets the borage, mustard/crucifer, and amaranth/goosefoot families. Many plant families are susceptible to picloram, but the aster/composite and legume/pea are especially susceptible (Appendix I).

Effects Determination

Direct effects to bighorn sheep as a result of herbicide toxicity are unlikely. The assumptions for the exposure scenarios are that in an acute scenario 100% of the diet is contaminated vegetation that was sprayed directly and in the chronic scenario the animal consumes vegetation for a 90 day period after herbicide application (consisting of 30% of the diet), or the animal eats vegetation 25 to 100 feet from the application site, but 100% of the diet is assumed to be contaminated by drift. The four herbicides that had hazard quotients that exceeded a level of concern for large mammals consuming contaminated vegetation would be applied by ground-based application methods. Spot spraying is targeted and covers an area far smaller than a foraging area for a bighorn sheep. Ground-based broadcast applications would be restricted to areas near roads and would also not encompass the entirety of foraging habitat. The toxicological significance of the HQ that could result at the maximum application level is relatively modest and would not be expected to result in obvious signs of toxicity.

Indirect effects from treatment methods are not expected to have a negative effect on bighorn sheep. Studies have shown that herbicide use may temporarily reduce the abundance of forb and shrub species, but that had little or no impact on the abundance of large mammalian herbivores (Sullivan and Sullivan 2003).

The amount of habitat alteration resulting from temporary decreases in forage species as a result of invasive plant treatment activities (herbicide, manual and mechanical, biological, and restoration activities) is not expected to have a noticeable effect on forage abundance. Rather, treatment activities are expected to have a long-term beneficial effect on overall forage quality and quantity.

The Current Action alternative may impact individual bighorn sheep, likely in a beneficial manner, but would not likely contribute to a trend towards Federal listing.

Spotted and Townsend's Big-eared Bats

Spotted bats generally roosting in cliff areas and foraging over dry forests. The potential habitat within the proposed action area has not been characterized. Townsend's big-eared bats utilize a wide range of habitats; roosting in caves, mine shafts, rock outcrops, lava tubes and occasionally buildings and foraging over tree canopies, wet meadows and other areas of open water with riparian vegetation. Recent surveys of abandoned mines have found roosts, if not abundant, nonetheless well distributed across the SCNF. The potential habitat within the proposed action area has not been characterized.

Two herbicides being analyzed, 2,4-D and dicamba, had HQ that exceeded the level of concern for the exposure scenario of small mammals consuming contaminated insects. 2,4-D also

The herbicide 2,4-D exceed the HQ LOC at the lowest application rate (HQ= 1.4), at the typical application rate (1 lb a.e./acre) (upper bound HQ=3), and at the highest anticipated application rate of 4 lb a.e./acre (HQ= 4 to 11) for the insect-eating scenario. The direct spray scenario exceed the LOC (HQ=4) at the highest anticipated application rate. The potential for observing an adverse effect in mammals other than canids is not well characterized.

For dicamba, at the maximum application rate of 2 lbs. a.e./acre, the level of concern was exceeded for the acute exposure scenario. Adverse effects to offspring, such as reduced survival, could be plausible at the upper ranges of exposure associated with the maximum application rate. Large mammals tend to be more sensitive to dicamba than small mammals. Dicamba is rapidly eliminated from the body by mammals.

Insects, primarily noctuid moths, are the sole prey of spotted bats. Townsend's big-eared bats prey primarily on noctuid moths, but also eat beetles, flies and other flying insects. Two herbicides being analyzed, chlorsulfuron and glyphosate, have exposure scenarios of direct spray of honeybees (as surrogate for other terrestrial insects) that resulted in HQs that exceeded a level of concern.

There is very little published data regarding the effects of chlorsulfuron on terrestrial invertebrates (SERA 2004a). The chemical is identified as being slightly toxic (LD50 > 25µg/bee) (USDOE BPA 2000a, EPA 1992). At the maximum application rate, the hazard quotient slightly exceeds the LOC (1.8) for honeybees. There is no basis to assert that direct spray would be likely to be lethal to insects or result in any adverse effects.

For the scenario of direct spray of glyphosate on a honeybee, the HQ would reach a level of concern (1) at the application rate of 3.3 lb a.e./acre. At the maximum application rate, the HQ would be 2.4. This would correlate to a dose that was found to have marginally significant mortality (3/60) which cannot exclude risks to honeybees being directly sprayed, but effects would likely not be substantial or detectable. The HQs were exceeded for the scenarios of insects consuming contaminated vegetation at the application rate of 1 lb a.e./acre thorough 8 lbs. a.e./acre. The use of toxicity data on honeybees as a surrogate for other terrestrial invertebrates adds uncertainty (SERA 2011).

Effects Determination

Direct effects to spotted and Townsend's big-eared bats as a result of herbicide toxicity are not expected. For the insect consumption scenario, bats would have to eat enough insects that were directly sprayed at the maximum application rate to give them a high enough doses to exceed the level of concern. Both herbicides are being proposed for ground-based application only, so the probability of a large enough number of insects within a bat's foraging area being contaminated is very low. The chance of a bat being directly sprayed is also very low. The very small chance of the scenarios occurring coupled with the very low populations that occur in the SCNF, make impacts unlikely.

Indirect effects to their prey base are not expected. Of the two herbicides that exceeded the LOC, there is no basis to assert lethality to insects or result in adverse effects or effects would likely not be substantial of detectable. The subsequent increase of native plants that support Lepidopteran species would be expected as a result of invasive plant treatment, which could result in an increase of the prey base for this species.

No effects are expected to as a result of biological or manual/mechanized treatment methods or cultural restoration activities.

The Current Action alternative may impact individual spotted or Townsend's big-eared bats, likely in a beneficial manner, but would not likely contribute to a trend towards Federal listing.

Pygmy Rabbit

Pygmy rabbit habitat has not been specifically modeled in the SCNF. However, they utilize big sagebrush habitats almost exclusively. There are 12,245 acres of known invasive plant infestations within the 343,095 acres of mountain and Wyoming big sage in the SCNF. Of those, 7,866 acres (64%) are spotted knapweed, 1,400 acres (11%) are Canada thistle, and 506 acres (11%) are Canada thistle (Appendix P).

Of the ten herbicides proposed for upland use in the SCNF, one herbicide, 2,4-D, has an acute exposure scenario of a small mammal being directly sprayed, three herbicides, 2,4-D, picloram, and triclopyr have acute exposure scenarios that exceed a hazard quotient level of concern for small mammals eating contaminated vegetation; and two herbicides, picloram and triclopyr, have chronic exposure scenarios that exceed a hazard quotient level of concern for small mammals eating contaminated vegetation.

For 2,4-D, at the typical application rate (1 lb a.e. /acre), hazard quotients exceed the LOC for the acute scenarios of small mammals eating grass (upper bound HQ=1.7). At the highest anticipated application rate of 4 lb a.e./acre two acute scenarios have HQ that exceed the LOC; direct spray of a

small mammal (HQ= 4), and small mammals eating contaminated grass (HQ= 2 to 7), The potential for observing an adverse effect in mammals other than canids is not well characterized (USDA Forest Service 2006).

For picloram, the acute exposure scenarios of consumption of short contaminated grass by a small mammal, has an upper bound HQ of 3. The chronic exposure scenarios that involves the consumption of contaminated grasses result in HQs that exceed the LOC for small mammals (HQ= 12). A study in rats determined that the LOAEL (lowest observed adverse effect level), corresponded to an HQ of 3. The HQ of 12 for a small mammal is above several sub-chronic LOAEL, none of which was associated with evident signs of toxicity. Secondary effects are associated with potential decreases in food supplies rather than direct toxic effects of picloram.

For triclopyr, the HQs for mammals increase as body weight increases. Both acute and chronic exposure scenarios for small mammals eating contaminated vegetation had upper range HQs that exceeded the LOC at an application rate of 1 lb a.e./acre; central estimate HQ=0.3, range of 0.02 to 1.6 and HQ=0.7, range of 0.03 to 7, respectively. Data suggest that HQs of about 4 could be related to adverse effects such as changes in blood chemistry or birth defects. Overt signs of toxicity would not likely be observed. The hazard quotients developed in risk assessments suggest that adverse effects could occur to mammalian wildlife at application rates generally used by the Forest Service. The exposure scenario is designed to be extreme; the assumption is that 100% of the diet would be contaminated, which would not realistically occur.

From a habitat and forage perspective, sagebrush is the most important plant to pygmy rabbits, followed by grass and forbs. Perennial grasses, once they are past the seedling stage, are largely tolerant of the thirteen herbicides being analyzed. Some herbicides, such as imazapic, metsulfuron methyl, and sulfometuron methyl are used to control annual grasses. The use of pre-emergent herbicides to control annual grasses such as cheatgrass is recommended as a sage-grouse habitat management guideline, which is also applicable to pygmy rabbit habitat (Connelly et al. 2000).

Evergreen shrubs seedling injury or mortality can result from the application of 2,4-D, chlorsulfuron, dicamba, metsulfuron methyl, and picloram; mature shrubs are largely tolerant, although minor foliar injury such as leaf curl/cupping, chlorosis, epinasty, or defoliation could occur. Shrubs are very tolerant to applications of clopyralid and imazapic. Applications of sulfometuron methyl could result in injury or mortality of all age classes of shrubs at application rates of above one ounce per acre (Appendix I).

Since most of the target species are forbs, it is reasonable to expect that forbs are susceptible to herbicide application. All forb families are susceptible to 2,4-D to some degree and most forb families are susceptible to dicamba and glyphosate. The legume/pea (Fabaceae) family is susceptible to chlorsulfuron, clopyralid, dicamba, picloram, sulfometuron methyl, and triclopyr. The aster/composite (Asteraceae) family is susceptible to clopyralid and picloram, yet is tolerant to chlorsulfuron, imazapic, sulfometuron methyl, and triclopyr. Most forb families are not susceptible to imazapic and metsulfuron methyl (Appendix I).

Effects Determination

Direct effects to pygmy rabbits as result of herbicide toxicity are not likely to occur. The herbicides discussed above are believed to have risk estimates that overestimate potential field exposures; that adverse effects are not likely to occur; there would be no basis to assert that signs of toxicity would

be observed after exposure; or the prevalence and severity of potential effects cannot be characterized. Triclopyr was the only herbicide that could result in adverse effects (to offspring). Both triclopyr and 2,4-D herbicide would be applied via ground-based methods, so application would be targeted.

Habitat effects would be generally considered to be beneficial. The herbicide that is most damaging to evergreen shrubs, sulfometuron methyl, would be used situations to control annual grasses and would not be used on areas that had healthy, robust stands of sage-brush. The herbicides used in sage-grouse habitat would be selected specifically to have the greatest efficacy on the target species with the least impact to non-target species. The overarching goal of utilizing herbicides in these habitats is to reduce to invasive plant populations and enhance native herbaceous and shrub populations.

No impacts are expected to as a result of biological or manual/mechanized treatment methods or cultural restoration activities.

The Current Action alternative may impact individual pygmy rabbits, but would not likely contribute to a trend towards Federal listing.

Bald Eagle

Bald eagles utilize habitat that generally consists of forested areas near waterbodies with high quality foraging opportunities. Bald eagle habitat is not modeled in the SCNF, but there are 3,150 acres of currently identified invasive plant infestations in the approximately 36,000 acres of riparian cover type (Appendix P).

None of the herbicides analyzed had an exposure scenario of a predatory bird consuming a contaminated small mammal or fish that exceeded a hazard quotient level of concern.

There would be no broadcast application of herbicides in riparian areas, and no applications would occur if sustained wind speeds exceed 5 mph or label directions in order to prevent drift and damage to non-target riparian plant species.

Effects Determination

Direct effects to bald eagles as result of herbicide toxicity are not likely.

Indirect effects from habitat alteration are expected to be negligible. Applications would be targeted, since no broadcast application would occur in riparian areas, so non-target species damage would be expected to be minimal.

The Current Action alternative is expected to have no impact on bald eagles.

Northern Goshawk

Goshawk habitat has not been modeled in the SCNF. Although they have not been observed on all Ranger Districts (or all Invasive Plant Management Zones), the lack of detection does not prove absence, since detections are usually due to project-level surveys and these may not have been conducted consistently across the SCNF. Utilizing the cover types of conifer across the analysis area, there are 25,600 acres of known invasive plant infestations within the approximately 1.7 million

acres of conifer cover type. Of the known invasive plant infestations in the conifer cover type, the top three are knapweed (85%), hoary alyssum (5%), and Canada thistle (3%) (Appendix P).

None of the herbicides analyzed had an exposure scenario of a predatory bird consuming a contaminated small mammal that exceeded a hazard quotient level of concern.

Goshawk habitat predominantly consists of conifer forests. Conifers are largely tolerant of the proposed herbicides at typical application rates. Common injuries to conifers include chlorosis, needle shed, needle curl, and branch die-back. Dicamba and picloram can result in root uptake if applied within the drip line. Seedlings are susceptible to injury from application of 2,4-D (Appendix I).

Effects Determination

Direct effects to goshawks as result of herbicide toxicity are not likely.

Indirect effects as a result of habitat alteration from herbicide applications are not likely. The number of currently known infested acres comprises 0.02% of conifer cover type within the proposed action area. Conifers are largely tolerant of the herbicides proposed.

Indirect effects as a result of prey availability from all invasive plant treatment methods are likely to be beneficial. Overall, the treatment methods would positively influence forage for key prey species such as passerine birds and small mammals, which would result in a potential improvement in the prey base.

The Current Action alternative may impact individual goshawks, likely in a beneficial manner, but would not likely contribute to a trend towards Federal listing.

American Peregrine Falcon

Peregrine falcons nest on cliff faces; locations that would not be expected to be susceptible to invasive plant infestations. Foraging habitat tends to occur near riparian areas and meadows. There are 3,150 acres of currently identified noxious invasive plant infestations in the approximately 36,000 acres of riparian cover type (Appendix P).

None of the herbicides analyzed had an exposure scenario of a predatory bird consuming a contaminated small mammal (proxy) that exceeded a hazard quotient level of concern.

Deciduous trees and shrubs, which are an important habitat component for prey species, are largely tolerant of the herbicides proposed for use in riparian areas at application rates used for forbs. Injury, such as leaf cupping or curling, chlorosis, and/or potential defoliation, as well as injury or mortality for seedlings could occur. Deciduous woody species are more susceptible to injury or death from sulfometuron methyl. There would be no broadcast application in riparian areas, and no applications would occur if sustained wind speeds exceed 5 mph or label directions in order to prevent drift and damage to non-target riparian plant species.

Effects Detemination

Direct effects to peregrine falcons as result of herbicide toxicity are not likely.

Indirect effects as a result of prey availability from all invasive plant treatment methods are likely to be beneficial. Overall, the treatment methods would positively influence forage for key prey species such as passerine birds, which would result in a potential improvement in the prey base.

The Current Action alternative may impact individual peregrine falcons, likely in a beneficial manner, but would not likely contribute to a trend towards Federal listing.

Boreal Owl

Boreal owl habitat has not been modeled in the SCNF. Although they have not been observed on all Ranger Districts (or all Invasive plant Zones), the lack of detection does not prove absence, since detections are usually due to surveys, which have only been conducted on the Challis-Yankee Fork and Middle Fork Ranger Districts. Utilizing the cover types of conifer across the analysis area, there are 25,600 acres of known invasive plant infestations within the approximately 1.7 million acres of conifer cover type. Of the known invasive plant infestations in the conifer cover type, the top three are knapweed (85%), hoary alyssum (5%), and Canada thistle (3%) (Appendix P).

None of the herbicides analyzed had an exposure scenario of a predatory bird consuming a contaminated small mammal that exceeded a hazard quotient level of concern. Three herbicides had hazard quotients that exceeded the level of concern for exposure scenarios of birds consuming contaminated insects. The acute exposure scenario for 2,4-D, at an application rate of 4 lb a.e./acre results in in a HQ of 1.1. It is likely that risk estimates derived from gavage studies overestimate actual field exposure. The acute exposure scenario for dicamba, at the maximum application rate of 2 lbs. a.e./acre of dicamba, the HQ was slightly exceeded (no number given). The acute exposure scenario for triclopyr resulted in a modest exceedance of the upper bound HQ of 0.3 (range of 0.02 to 1.8). The HQs are based on residue rates that are equivalent to rates used for broadleaf vegetation. Avian field studies are not as numerous or detailed as those for mammals and do not confirm or refute toxicity concerns based on HQs.

Boreal owl habitat predominantly consists of conifer forests. Conifers are largely tolerant of the proposed herbicides at typical application rates. Common injuries to conifers include chlorosis, needle shed, needle curl, and branch die-back. Dicamba and picloram can result in root uptake if applied within the drip line. Seedlings are susceptible to injury from application of 2,4-D (Appendix I).

Effects Determination

Direct effects to boreal owls as a result of herbicide toxicity are not expected. No hazard quotients were exceeded for the consumption of mammalian or avian prey. For the insect consumption scenario, owls would have to eat enough insects that were directly sprayed at the maximum application rate to give them a high enough doses to exceed the level of concern. All herbicides are being proposed for ground-based application only, so the probability of a large enough number of insects within an owl's foraging area being contaminated is very low. The very small chance of the scenarios occurring coupled with the low populations that occur in the SCNF, make impacts unlikely.

Indirect effects as a result of habitat alteration from herbicide applications are not likely. The number of currently known infested acres comprises 0.02% of conifer cover type within the proposed action area. Conifers are largely tolerant of the herbicides proposed.

Indirect effects as a result of prey availability from all invasive plant treatment methods are likely to be beneficial. Overall, the treatment methods would positively influence forage for key prey species such as passerine birds, small mammals, and insects; which would result in a potential improvement in the prey base.

The Current Action alternative may impact individual boreal owls, likely in a beneficial manner, but would not likely contribute to a trend towards Federal listing.

Flammulated Owl and Three-toed Woodpecker

Flammulated owl and three-toed woodpecker habitat has not been modeled in the SCNF. Although they have not been observed on all Ranger Districts (or all Invasive Plant Management Zones), the lack of detection does not prove absence, since detections are usually due to surveys, which have only been conducted on the Challis-Yankee Fork, Middle Fork Ranger Districts, and North Fork. Utilizing the cover types of conifer across the analysis area, there are 25,600 acres of known invasive plant infestations within the approximately 1.7 million acres of conifer cover type. Of the known invasive plant infestations in the conifer cover type, the top three are knapweed (85%), hoary alyssum (5%), and Canada thistle (3%) (Appendix P).

Three herbicides had hazard quotients that exceeded the level of concern for exposure scenarios of birds consuming contaminated insects. The acute exposure scenario for 2,4-D, at an application rate of 4 lb a.e./acre results in in a HQ of 1.1. It is likely that risk estimates derived from gavage studies overestimate actual field exposure. The acute exposure scenario for dicamba, at the maximum application rate of 2 lbs. a.e./acre of dicamba, the HQ was slightly exceeded (no number given). The acute exposure scenario for triclopyr resulted in a modest exceedance of the upper bound HQ of 0.3 (range of 0.02 to 1.8). The HQs are based on residue rates that are equivalent to rates used for broadleaf vegetation. Avian field studies are not as numerous or detailed as those for mammals and do not confirm or refute toxicity concerns based on HQs.

Flammulated owl and three-toed woodpecker habitat predominantly consists of conifer forests. Conifers are largely tolerant of the proposed herbicides at typical application rates. Common injuries to conifers include chlorosis, needle shed, needle curl, and branch die-back. Dicamba and picloram can result in root uptake if applied within the drip line. Seedlings are susceptible to injury from application of 2,4-D (Appendix I).

Effects Determination

Direct effects to flammulated owls and three-toed woodpeckers as a result of herbicide toxicity are not expected. For the insect consumption scenario, owls and woodpeckers would have to eat enough insects that were directly sprayed at the maximum application rate to give them a high enough doses to exceed the level of concern. All herbicides are being proposed for ground-based application only, so the probability of a large enough number of insects within an owl's and woodpecker's foraging area being contaminated is very low. The very small chance of the scenarios occurring makes impacts unlikely.

Indirect effects as a result of habitat alteration from herbicide applications are not likely. The number of currently known infested acres comprises 0.02% of conifer cover type within the proposed action area. Conifers are largely tolerant of the herbicides proposed.

Indirect effects as a result of prey availability from all invasive plant treatment methods are likely to be beneficial. Overall, the treatment methods would positively influence forage for key prey species such as insects; which would result in a potential improvement in the prey base.

The Current Action alternative may impact individual flammulated owls or three-toed woodpeckers, likely in a beneficial manner, but would not likely contribute to a trend towards Federal listing.

Great Gray Owl

Great grey owl habitat has not been modeled in the SCNF. Although they have not been observed on all Ranger Districts (or all Invasive Plant Management Zones), the lack of detection does not prove absence, since detections are usually due to project -level surveys and these may not have been conducted consistently across the SCNF. Utilizing the cover types of conifer and riparian across the analysis area, there are approximately 3,150 acres of known invasive plant infestations within the approximately 36,000 acres of riparian cover type and approximately 25,600 acres of known invasive plant infestations within the approximately 1.7 million acres of conifer cover type. Of the known invasive plant infestations in these cover types, the top three are knapweed (83%), musk thistle (5%), and Canada thistle (4%) (Appendix P).

None of the herbicides analyzed had an exposure scenario of a predatory bird consuming a contaminated small mammal that exceeded a hazard quotient level of concern.

Great grey owl habitat predominantly consists of conifer forests and open meadows. Conifers are largely tolerant of the proposed herbicides at typical application rates. Common injuries to conifers include chlorosis, needle shed, needle curl, and branch die-back. Dicamba and picloram can result in root uptake if applied within the drip line. Seedlings are susceptible to injury from application of 2,4 (Appendix I).

There would be no broadcast application in riparian areas, and no applications would occur if sustained wind speeds exceed 5 mph or label directions in order to prevent drift and damage to non-target riparian plant species.

Effects Determination

Direct effects to great grey owls as result of herbicide toxicity are not likely.

Indirect effects as a result of habitat alteration from herbicide applications are not likely. The number of currently known infested acres comprises 0.02% of conifer cover type within the proposed action area. Conifers are largely tolerant of the herbicides proposed.

Indirect effects as a result of prey availability from all invasive plant treatment methods are likely to be beneficial. Overall, the treatment methods would positively influence forage for key prey species such as small mammals, which would result in a potential improvement in the prey base.

The Current Action alternative may impact individual great grey owls, likely in a beneficial manner, but would not likely contribute to a trend towards Federal listing.

Harlequin Duck

There have been no documented occurrences of harlequin ducks breeding on the Salmon-Challis National Forest. There are 3,150 acres of currently identified invasive plant infestations in the

approximately 36,000 acres of riparian cover type (Appendix P). Six of the herbicides proposed for use in riparian areas had no exposure scenarios that exceed a hazard quotient for birds. Clopyralid had a scenario that had a hazard quotient that exceeded levels of concern for birds consuming vegetation of a long period of time. That would not apply to harlequin ducks, since they are primarily invertivores. One herbicide, triclopyr, did have a modest exceedance of the upper bound HQ of 0.3 (range of 0.02 to 1.8) for the scenario of a small bird consuming contaminated insects. Again, that may not apply to harlequin ducks (SERA 2011).

Deciduous trees and shrubs, which are an important habitat component for this species, are largely tolerant of the herbicides proposed for use in riparian areas at application rates used for forbs. Injury, such as leaf cupping or curling, chlorosis, and/or potential defoliation, as well as injury or mortality for seedlings could occur. Deciduous woody species are more susceptible to injury or death from sulfumeturon methyl (Appendix I). There would be no broadcast application in riparian areas, and no applications would occur if sustained wind speeds exceed 5 mph or label directions in order to prevent drift and damage to non-target riparian plant species.

This alternative does not consider aquatic treatments. If there were to be an infestation of aquatic invasive plants, there would need to be coordination and consultation with state and Federal regulatory agencies completed before control efforts could take place. The time lapse could result in the infestation expanding and exceeding the EDRR eradication threshold.

Effects Determination

Direct effects to harlequin ducks as result of herbicide toxicity are unlikely. The one herbicide, triclopyr, which had a scenario of birds consuming contaminated insects that slightly exceeded the upper bound HQ, is an herbicide that is rarely used (Table 3-49). The anticipated low use of the herbicide combined with the very low number of sightings of the species, decreases the possibility of effects.

Indirect effects from habitat alteration are also expected to be negligible. Of the seven herbicides that are proposed for use in riparian areas, deciduous woody species are susceptible to one of them. Applications would be targeted, since no broadcast application would occur in riparian areas, so non-target species damage would be expected to be minimal.

No effects are expected to as a result of biological or manual/mechanized treatment methods or cultural restoration activities.

The lack of aquatic treatment options in this alternative could result in the expansion of aquatic invasive plants beyond an eradication threshold. This could result in negative effects to aquatic habitat.

The Current Action alternative may impact individual harlequin ducks, but would not likely contribute to a trend towards Federal listing.

Management Indicator Species

Pileated Woodpecker

Pileated woodpecker transects have been set up on all Ranger Districts in the SCNF. Utilizing the cover types of conifer across the analysis area, there are 25,600 acres of known invasive plant

infestations within the approximately 1.7 million acres of conifer cover type. Of the known invasive plant infestations in the conifer cover type, the top three are knapweed (85%), hoary alyssum (5%), and Canada thistle (3%) (Appendix P).

Three herbicides had hazard quotients that exceeded the level of concern for exposure scenarios of birds consuming contaminated insects. The acute exposure scenario for 2,4-D, at an application rate of 4 lb a.e/acre results in in a HQ of 1.1. It is likely that risk estimates derived from gavage studies overestimate actual field exposure. The acute exposure scenario for dicamba, at the maximum application rate of 2 lbs a.e/acre of dicamba, the HQ was slightly exceeded (no number given). The acute exposure scenario for triclopyr resulted in a modest exceedance of the upper bound HQ of 0.3 (range of 0.02 to 1.8). The HQs are based on residue rates that are equivalent to rates used for broadleaf vegetation. Avian field studies are not as numerous or detailed as those for mammals and do not confirm or refute toxicity concerns based on HQs.

Pileated woodpecker habitat predominantly consists of conifer forests. Conifers are largely tolerant of the proposed herbicides at typical application rates. Common injuries to conifers include chlorosis, needle shed, needle curl, and branch die-back. Dicamba and picloram can result in root uptake if applied within the drip line. Seedlings are susceptible to injury from application of 2,4-D (Appendix I).

Effects Determination

Direct effects to pileated woodpeckers as a result of herbicide toxicity are not expected. For the insect consumption scenario, woodpeckers would have to eat enough insects that were directly sprayed at the maximum application rate to give them a high enough doses to exceed the level of concern. All three herbicides are being proposed for ground-based application only, so the probability of a large enough number of insects within a woodpecker's foraging area being contaminated is very low. The very small chance of the scenarios occurring makes impacts unlikely.

Indirect effects as a result of habitat alteration from herbicide applications are not likely. The number of currently known infested acres comprises 0.01% of conifer cover type within the proposed action area. Conifers are largely tolerant of the herbicides proposed.

Indirect effects as a result of prey availability from all invasive plant treatment methods are likely to be beneficial. Overall, the treatment methods would positively influence forage for key prey species such as insects; which would result in a potential improvement in the prey base.

Greater Sage-grouse

There are 12,245 acres of known invasive plant infestations within the 945,929 acres of potential sage-grouse habitat which comprises 0.01% of the habitat being infested. Within mapped seasonal breeding and brood rearing habitat, 304,625 acres there are 4,246 acres of known invasive plant infestations (Appendix P). The vast majority of infestations are spotted knapweed (64% and 50%, respectively).

Of the ten herbicides proposed for use in the SCNF, two herbicides, dicamba and picloram, have acute exposure scenarios that exceed a hazard quotient (HQ) level of concern (LOC) for birds eating contaminated vegetation; three herbicides, 2,4-D, dicamba, and triclopyr, exceed the HQ LOC for the acute exposure scenario of birds consuming contaminated insects; and two herbicides, clopyralid,

and picloram, have chronic exposure scenarios that exceed a hazard quotient level of concern for birds eating contaminated vegetation.

Birds appear to be far less sensitive to 2,4-D than mammals. One acute exposure scenario, consumption of contaminated insects at an application rate of 4 lb a.e/acre results in in a HQ of 1.1. It is likely that risk estimates derived from gavage studies overestimate actual field exposure. For birds, secondary effects may occur through changes to vegetation that may impact food availability and habitat (USDA Forest Service 2006).

Clopyralid is relatively non-toxic to terrestrial animals. The only exposure scenario to slightly exceed the level of concern (1.3) is the consumption of contaminated vegetation for 90 days by a large bird at the maximum application rate. This scenario is implausible because at that application rate the vegetation would die or be substantially damaged. This scenario is used as a very conservation upper estimate of potential exposure and risk. The available data is sufficient to assert that adverse effects in terrestrial animals are not likely to occur (SERA 2004b).

For dicamba, no exposure scenario results in an exceedance of a level of concern at the typical application rate. No adverse effects are anticipated for birds or mammals at a typical application rate. At the maximum application rate the level of concern was exceeded for acute exposure scenarios involving the consumption of vegetation for birds (1.7). Adverse effects to offspring, such as reduced hatchability and survival, could be plausible at the upper ranges of exposure associated with the maximum application rate. The species that dicamba is recommended to be used to control, namely musk and Canada thistles and leafy spurge, represent a very small amount of the potential habitat and the seasonal breeding and brood rearing habitat (approximately 0.3 to 0.4%) (Appendix P).

In an acute scenario for picloram, a small bird eating contaminated grasses resulted in an upper bound HQ of 1.1, which is modest enough of an exceedance of the HQ that it can be dismissed. The chronic exposure scenario of a small bird eating contaminated grass has an upper bound HQ of 9. The scenario corresponds with an estimated daily dose that is more than four times the LOAEL. A reservation with the scenario is that although some species of small birds may eat grass; it is generally not a major portion of the diet. The upper bound HQ of 9 may be interpreted that for chronic exposure, adverse effects in some, especially young, birds may not be ruled out; however prevalence and severity of effects cannot be characterized.

The acute exposure scenario for triclopyr of birds consuming contaminated insects resulted in a modest exceedance of the upper bound HQ of 0.3 (range of 0.02 to 1.8). The HQs are based on residue rates that are equivalent to rates used for broadleaf vegetation. Avian field studies are not as numerous or detailed as those for mammals and do not confirm or refute toxicity concerns based on HQs.

Insects are an important component of the diet of breeding hens and chicks. There is very little published data regarding the effects of chlorsulfuron on terrestrial invertebrates (SERA 2004a). The chemical is identified as being slightly toxic (LD50 > 25µg/bee) (USDOE BPA 2000a, EPA 1992). At the maximum application rate, the hazard quotient slightly exceeds the LOC (1.8) for honeybees. There is no basis to assert that direct spray would be likely to be lethal to insects or result in any adverse effects.

For the scenario of direct spray of glyphosate on a honeybee, the HQ would reach a level of concern (1) at the application rate of 3.3 lb a.e./acre. At the maximum application rate, the HQ would be 2.4. This would correlate to a dose that was found to have marginally significant mortality (3/60) which cannot exclude risks to honeybees being directly sprayed, but effects would likely not be substantial or detectable. The HQs were exceeded for the scenarios of insects consuming contaminated vegetation at the application rate of 1 lb a.e./acre thorough 8 lbs. a.e./acre. The use of toxicity data on honeybees as a surrogate for other terrestrial invertebrates adds uncertainty (SERA 2011).

From a habitat and forage perspective, sagebrush, forbs (especially those in the composite family), and grasses are important to sage-grouse. Perennial grasses, once they are past the seedling stage, are largely tolerant of the thirteen herbicides being analyzed. Some herbicides, such as imazapic, metsulfuron methyl, and sulfometuron methyl are used to control annual grasses. The use of pre-emergent herbicides to control annual grasses such as cheatgrass is recommended as a sage-grouse habitat management guideline (Connelly et al. 2000).

Evergreen shrub seedling injury or mortality can result from the application of 2,4-D, chlorsulfuron, dicamba, metsulfuron methyl, and picloram; mature shrubs are largely tolerant, although minor foliar injury such as leaf curl/cupping, chlorosis, epinasty, or defoliation could occur. Shrubs are very tolerant to applications of clopyralid and imazapic. Applications of sulfometuron methyl could result in injury or mortality of all age classes of shrubs at application rates of above one ounce per acre (Appendix I).

Since most of the target species are forbs, it is reasonable to expect that forbs are susceptible to herbicide application. All forb families are susceptible to 2,4-D to some degree and most forb families are susceptible to dicamba and glyphosate. The legume/pea (Fabaceae) family is susceptible to chlorsulfuron, clopyralid, dicamba, picloram, sulfometuron methyl, and triclopyr. The aster/composite (Asteraceae) family is susceptible to clopyralid and picloram, yet is tolerant to chlorsulfuron, imazapic, sulfometuron methyl, and triclopyr. Most forb families are not susceptible to imazapic and metsulfuron methyl (Appendix I).

Effects Determination

Direct effects to sage-grouse as result of herbicide toxicity are unlikely to occur. The herbicides discussed above are believed to have risk estimates that overestimate potential field exposures; that adverse effects are not likely to occur; there would be no basis to assert that signs of toxicity would be observed after exposure; or the prevalence and severity of potential effects cannot be characterized. Dicamba was the only herbicide that could result in adverse effects (to offspring). The proportion of potential habitat that dicamba could be used on is very low (0.3% of the potential habitat and 0.4% of the seasonal breeding and brood rearing habitat). A design criterion specific to sage-grouse is that no aerial application would occur within known or potential sage-grouse nesting/early brood-rearing habitat until after June 30 to prevent any potential impacts to nesting hens or chicks.

Indirect effects resulting from a decrease in insect availability are not expected. The risk assessments for both herbicides that had LOC exceeded for honeybees (as a surrogate for other terrestrial insects) concluded that effects would likely not be substantial or detectable or there is no basis to assert that direct spray would be likely to be lethal to insects or result in any adverse effects.

Habitat effects would be generally considered to be beneficial. The herbicide that is most damaging to evergreen shrubs, sulfometuron methyl, would be used situations to control annual grasses and would not be used on areas that had healthy, robust stands of sage-brush. The herbicides used in sage-grouse habitat would be selected specifically to have the greatest efficacy on the target species with the least impact to non-target species. The overarching goal of utilizing herbicides in these habitats is to reduce to invasive plant populations and enhance native herbaceous and shrub populations.

No impacts are expected to as a result of biological or manual/mechanized treatment methods or cultural restoration activities.

The Current Action alternative may impact individual sage-grouse, but would not likely contribute to a trend towards Federal listing, or cause a loss of viability to the population or species or be expected to result in a downward trend for this species.

Columbia Spotted Frog

There are 3,150 acres of currently identified noxious invasive plant infestations in the approximately 36,000 acres of riparian cover type (Appendix P). None of the herbicides proposed for use in riparian areas or for aquatic use had exposure scenarios that exceed a hazard quotient for amphibians.

Perennial terrestrial grasses, once they are past the seedling stage, are largely tolerant of the herbicides being analyzed for use in riparian areas and for aquatic use. Some herbicides, such as metsulfuron methyl, are used to control annual grasses.

Since most of the target species are terrestrial forbs, it is reasonable to expect that forbs are susceptible to herbicide application. Most forbs are tolerant to metsulfuron methyl, since it is used to target annual grasses. Clopyralid targets the aster/composite, legume/pea, knotweed/buckwheat, and nightshade families; chlorsulfuron and sulfometuron methyl; and triclopyr target the borage, mustard/crucifer, and legume/pea families. Many plant families are susceptible to 2,4-D and glyphosate, but actively growing plants will tolerate some injury at low application rates and no injury would occur to dormant plants (Appendix I).

This alternative does not consider aquatic treatments. If there were to be an infestation of aquatic invasive plants, there would need to be coordination and consultation with state and Federal regulatory agencies completed before control efforts could take place. The time lapse could result in the infestation expanding and exceeding the EDRR eradication threshold.

Effects Determination

Direct effects spotted frogs as result of herbicide toxicity are not likely to occur, since none of the herbicides exceeded any thresholds that may indicate potential harm. Indirect effects from habitat alteration are expected to be minimal. Terrestrial grasses are largely tolerant and forb susceptibility caries; however, applications would be targeted, since no broadcast application would occur in riparian areas, so non-target species damage would be expected to be nominal.

The lack of aquatic treatment options in this alternative could result in the expansion of aquatic invasive plants beyond an eradication threshold. This could result in negative effects to aquatic habitat.

The Current Action alternative may impact individual Columbia spotted frogs, but would not likely contribute to a trend towards Federal listing, or cause a loss of viability to the population or species or be expected to result in a downward trend for this species.

Migratory Breeding Birds

The high priority breeding birds (Table 3-44) are widely adapted to many habitat types and require many different habitat components seasonally, so presumably they could utilize every cover type-alpine, sagebrush-steppe, grassland, high-elevation mixed conifer, low-elevation mixed conifer, ponderosa pine, juniper/mountain mahogany, non-riverine wetlands, aspen, and cliffs. Within the approximately 3.1 million acre action area, there are 49,135 acres of identified invasive plant infestations (Appendix P).

Of the ten herbicides proposed for use in the SCNF, five herbicides had exposure scenarios for birds that exceed HQ levels of concern. Two herbicides, dicamba and picloram, have acute exposure scenarios that exceed a hazard quotient level of concern for birds eating contaminated vegetation; three herbicides, 2,4-D, dicamba, triclopyr, exceed the HQ LOC for the acute exposure scenario of birds consuming contaminated insects; and two herbicides, clopyralid and picloram, have chronic exposure scenarios that exceed a hazard quotient level of concern for birds eating contaminated vegetation.

Birds appear to be far less sensitive to 2,4-D than mammals. One acute exposure scenario, consumption of contaminated insects at an application rate of 4 lb a.e./acre results in in a HQ of 1.1. It is likely that risk estimates derived from gavage studies overestimate actual field exposure. For birds, secondary effects may occur through changes to vegetation that may impact food availability and habitat (USDA Forest Service 2006).

Clopyralid is relatively non-toxic to terrestrial animals. The only exposure scenario to slightly exceed the level of concern (1.3) is the consumption of contaminated vegetation for 90 days by a large bird at the maximum application rate. This scenario is implausible because at that application rate the vegetation would die or be substantially damaged. This scenario is used as a very conservation upper estimate of potential exposure and risk. The available data is sufficient to assert that adverse effects in terrestrial animals are not likely to occur (SERA 2004b).

For dicamba, no exposure scenario results in an exceedance of a level of concern at the typical application rate. No adverse effects are anticipated for birds or mammals at a typical application rate. At the maximum application rate the level of concern was exceeded for acute exposure scenarios involving the consumption of vegetation for birds (1.7). Adverse effects to offspring, such as reduced hatchability and survival, could be plausible at the upper ranges of exposure associated with the maximum application rate.

In an acute scenario for picloram, a small bird eating contaminated grasses resulted in an upper bound HQ of 1.1, which is modest enough of an exceedance of the HQ that it can be dismissed. The chronic exposure scenario of a small bird eating contaminated grass has an upper bound HQ of 9. The scenario corresponds with an estimated daily dose that is more than four times the LOAEL. A reservation with the scenario is that although some species of small birds may eat grass; it is generally not a major portion of the diet. The upper bound HQ of 9 may be interpreted that for chronic exposure, adverse effects in some, especially young, birds may not be ruled out; however prevalence and severity of effects cannot be characterized.

The acute exposure scenario for triclopyr of birds consuming contaminated insects resulted in a modest exceedance of the upper bound HQ of 0.3 (range of 0.02 to 1.8). The HQs are based on residue rates that are equivalent to rates used for broadleaf vegetation. Avian field studies are not as numerous or detailed as those for mammals and do not confirm or refute toxicity concerns based on HQs.

None of the herbicides analyzed had an exposure scenario of a predatory bird consuming a contaminated small mammal or fish that exceeded a hazard quotient level of concern.

Insects are an important component of the diet many of the high priority breeding birds. There is very little published data regarding the effects of chlorsulfuron on terrestrial invertebrates (SERA 2004a). The chemical is identified as being slightly toxic (LD50 > 25µg/bee) (USDOE BPA 2000a, EPA 1992). At the maximum application rate, the hazard quotient slightly exceeds the LOC (1.8) for honeybees. There is no basis to assert that direct spray would be likely to be lethal to insects or result in any adverse effects.

For the scenario of direct spray of glyphosate on a honeybee, the HQ would reach a level of concern (1) at the application rate of 3.3 lb a.e./acre. At the maximum application rate, the HQ would be 2.4. This would correlate to a dose that was found to have marginally significant mortality (3/60) which cannot exclude risks to honeybees being directly sprayed, but effects would likely not be substantial or detectable. The HQs were exceeded for the scenarios of insects consuming contaminated vegetation at the application rate of 1 lb a.e./acre thorough 8 lbs a.e./acre. The use of toxicity data on honeybees as a surrogate for other terrestrial invertebrates adds uncertainty (SERA 2011).

Conifers are largely tolerant of the proposed herbicides at typical application rates. Common injuries to conifers include chlorosis, needle shed, needle curl, and branch die-back. Dicamba and picloram can result in root uptake if applied within the drip line. Seedlings are susceptible to injury from application of 2,4-D (Appendix I).

Deciduous trees and shrubs, which are an important habitat component for many migratory bird species, are largely tolerant of the herbicides proposed for use in riparian areas at application rates used for forbs. Injury, such as leaf cupping or curling, chlorosis, and/or potential defoliation, as well as injury or mortality for seedlings could occur. Deciduous woody species are more susceptible to injury or death from sulfometuron methyl. There would be no broadcast application in riparian areas, and no applications would occur if sustained wind speeds exceed 5 mph or label directions in order to prevent drift and damage to non-target riparian plant species.

Evergreen shrub seedling injury or mortality can result from the application of 2,4-D, chlorsulfuron, dicamba, metsulfuron methyl, and picloram; mature shrubs are largely tolerant, although minor foliar injury such as leaf curl/cupping, chlorosis, epinasty, or defoliation could occur. Shrubs are very tolerant to applications of clopyralid and imazapic. Applications of sulfometuron methyl could result in injury or mortality of all age classes of shrubs at application rates of above one ounce per acre (Appendix I).

Perennial grasses, once they are past the seedling stage, are largely tolerant of the ten herbicides being analyzed. Some herbicides, such as imazapic, metsulfuron methyl, and sulfometuron methyl are used to control annual grasses.

Since most of the target species are forbs, it is reasonable to expect that forbs are susceptible to herbicide application. The seven herbicides proposed for aerial use are selective and are used to target specific families of plants. Most native forbs are moderately tolerant to tolerant of aminopyralid and most forbs are tolerant to metsulfuron methyl, since it is used to target annual grasses. Clopyralid targets the aster/composite, legume/pea, knotweed, and nightshade families; chlorsulfuron, sulfometuron methyl, and triclopyr target the borage, mustard/crucifer, and legume/pea families; and imazapic targets the borage, mustard/crucifer, and amaranth/goosefoot families. Many plant families are susceptible to picloram, but the aster/composite and legume/pea are especially susceptible. Most forb families are susceptible to dicamba, but the legume/pea is especially susceptible. Many plant families are susceptible to 2,4-D and glyphosate, but actively growing plants will tolerate some injury at low application rates and no injury would occur to dormant plants (Appendix I).

Effects Determination

Direct effects to migratory birds as result of herbicide toxicity are not likely to occur. The herbicides discussed above are believed to have risk estimates that overestimate potential field exposures; that adverse effects are not likely to occur; there would be no basis to assert that signs of toxicity would be observed after exposure; or the prevalence and severity of potential effects cannot be characterized. Dicamba was the only herbicide that could result in adverse effects (to offspring). For picloram, adverse effects may not be ruled out, but prevalence and severity of effects cannot be characterized.

Design criteria for herbicide application would ensure herbicides would be applied safely and appropriately.

Indirect effects from treatment methods are not expected to have a long-term negative effect on migratory birds. Studies that looked at the aerial application of glyphosate to control brush found that the treatments resulted in vegetation that was structurally less complex and a reduction in abundance of invertebrates. Birds that used shrub habitat for foraging and nesting declined in abundance post-treatment, more so than species that tended to be habitat generalists (Morrison and Meslow 1984, Santillo et al. 1989). Once the vegetation recovered from the herbicide treatment, bird abundance increased (Morrison and Meslow 1984). The use of selective herbicide in shrub habitats did not affect nesting success of population density (Marshall and Vandruff 2002).

The lack of aquatic treatment options in this alternative could result in the expansion of aquatic invasive plants beyond an eradication threshold. This could result in negative effects to aquatic habitat.

The amount of habitat alteration resulting from temporary decreases in forage species as a result of invasive plant treatment activities (herbicide, manual and mechanical, biological, and restoration activities) is not expected to have a noticeable effect on nesting or roosting habitat or forage abundance. Rather, treatment activities are expected to have a long-term beneficial effect on overall habitat quality and quantity. The lack of aerial treatment would reduce the overall number of acres and not allow for treatment in inaccessible areas which could slow or prevent landscape-wide native plant community restoration on parts of the SCNF.

Ungulates-Elk

Elk are present on all Ranger Districts, therefore all invasive plant management zones. They are widely adapted to many habitat types and require many different habitat components seasonally, so presumably they could utilize every cover type. Within the approximately 3.1 million acre action area, there are 49,135 acres of identified noxious invasive plant infestations (Appendix P). Of the ten herbicides that are being analyzed for use, four had hazard quotients (HQs) that exceeded the level of concern (LOC) for the scenario of large mammals consuming contaminated vegetation. Three herbicides, 2,4-D, dicamba, and triclopyr, had acute scenarios that had HQs that exceeded levels of concern, and three, 2,4-D, picloram, and triclopyr, had chronic scenarios that had HQs that exceeded levels of concern.

At the typical application rate of 2, 4-D, (1 lb a.e./acre), hazard quotients exceed the LOC for the acute (upper bound HQ= 1.9) and chronic (upper bound HQ= 1.4) scenarios of large mammals eating contaminated vegetation. At the highest anticipated application rate of 4 lb. a.e./acre, hazard quotients exceed the LOC for the acute (HQ= 2 to 8) and chronic (upper bound HQ= 5) scenarios of large mammals eating contaminated vegetation.

At the typical application rate for dicamba, no exposure scenario results in an exceedance of a level of concern. No adverse effects are anticipated for mammals at a typical application rate. At the maximum application rate (2 lb. a.e. /acre), the level of concern was exceeded for acute exposure scenario involving the consumption of vegetation for both large mammals (HQ= 2). Adverse effects to offspring, such as reduced survival, could be plausible at the upper ranges of exposure associated with the maximum application rate. Large mammals tend to be more sensitive to dicamba than small mammals. Dicamba is rapidly eliminated from the body by mammals.

At the maximum application rate of 1 lb a.e./acres of picloram, the chronic exposure scenario of the consumption of contaminated grasses result in HQs that exceed the level of concern for large mammals (HQ= 1.5). A study in rats determined that the LOAEL (lowest observed adverse effect level), corresponded to an HQ of 3. The toxicological significance of the HQs of 1.5 and 3 appear to be questionable or at least relatively modest. Obvious signs of toxicity would not be expected at a chronic HQ of 3. Secondary effects are associated with potential decreases in food supplies rather than direct toxic effects of picloram.

For triclopyr, the HQs for mammals increase as body weight increases. Both acute and chronic exposure scenarios for large mammals eating contaminated vegetation had HQs that exceeded the LOC at an application rate of 1 lb a.e./acre. Based upon HQs that exceed LOC, the greatest risk would be to large mammals eating contaminated vegetation over a long time period (upper bound HQ=5, range of 0.2 to 53). Data suggest that HQs of about 4 could be related to adverse effects such as changes in blood chemistry or birth defects. Overt signs of toxicity would not likely be observed. The hazard quotients developed in risk assessments suggest that adverse effects could occur to mammalian wildlife at application rates generally used by the Forest Service. The exposure scenario is designed to be extreme; the assumption is that 100% of the diet would be contaminated, which would not realistically occur.

From a forage perspective, grasses and forbs, and to a lesser degree, shrubs, are very important to elk. Perennial grasses, once they are past the seedling stage, are largely tolerant of the ten herbicides being analyzed. Some herbicides, such as metsulfuron methyl, are used to control annual

grasses. Most families of forbs are susceptible. Shrubs are prone to seedling mortality and injury from foliar applications.

Since most of the target species are forbs, it is reasonable to expect that forbs are susceptible to herbicide application. Most forbs are tolerant to metsulfuron methyl, since it is used to target annual grasses. Clopyralid targets the aster/composite, legume/pea, knotweed, and nightshade families; chlorsulfuron and sulfometuron methyl target the borage, mustard/crucifer, and legume/pea families; and imazapic targets the borage, mustard/crucifer, and amaranth/goosefoot families. Many plant families are susceptible to picloram, but the aster/composite and legume/pea are especially susceptible (Appendix I).

Effects Determination

Direct effects to elk as a result of herbicide toxicity are unlikely. The assumptions for the exposure scenarios are that in an acute scenario 100% of the diet is contaminated vegetation that was sprayed directly and in the chronic scenario the animal consumes vegetation for a 90 day period after herbicide application (consisting of 30% of the diet), or the animal eats vegetation 25 to 100 feet from the application site, but 100% of the diet is assumed to be contaminated by drift. Three of the four herbicides that had hazard quotients that exceeded a level of concern for large mammals consuming contaminated vegetation would be applied by ground-based application methods. Spot spraying is targeted and covers an area far smaller than a foraging area for an elk. Ground- based broadcast applications would be restricted to areas near roads and would also not encompass the entirety of foraging habitat for elk. One herbicide, picloram, is proposed for aerial application, which can cover a larger area than ground-based application. The toxicological significance of the HQ that could result at the maximum application level is relatively modest and would not be expected to result in obvious signs of toxicity.

Indirect effects from treatment methods are not expected to have a negative effect on elk. Studies have shown that herbicide use may temporarily reduce the abundance of forb and shrub species, but that had little or no impact on the abundance of large mammalian herbivores (Sullivan and Sullivan 2003). Elk preferred foraging in areas that had invasive plants removed as a result of herbicide treatment over areas that had no treatment (Thompson 1996).

The amount of habitat alteration resulting from temporary decreases in forage species as a result of invasive plant treatment activities (herbicide, manual and mechanical, biological, and restoration activities) is not expected to have a noticeable effect on forage abundance. Rather, treatment activities are expected to have a long-term beneficial effect on overall forage quality and quantity. The lack of aerial treatment would reduce the overall number of acres and not allow for treatment in inaccessible areas which could slow or prevent landscape-wide native plant community restoration on parts of the SCNF.

3.5.7.3. Alternative 3-Proposed Action

Direct and Indirect Effects

Federally Listed or Candidate Speceis

Yellow-billed Cuckoo

Effects would be the same as described under Alternative 2- Current Action alternative.

Effects Determination

The Proposed Action Alternative may affect, but is not likely to adversely, and may beneficially affect yellow-billed cuckoos.

Canada Lynx

Effects would be similar as described under Alternative 2- Current Action alternative. There are 12 herbicides proposed for use in the upland areas; one, 2,4-D, has an exposure scenario that exceeds a hazard quotient level of concern for carnivores, the effects of which are described under Alternative 2.

Effects Determination

Direct effects to Canada lynx as a result of herbicide toxicity are unlikely. The combination of the small number of infested acres within the LAUs, the improbability of the exposure scenario (it is not likely that a snowshoe hare would be directly sprayed by 2,4-D then preyed upon by a lynx), and the low number of observations of lynx in the SCNF, decreases the possibility of effects.

Indirect effects as a result of habitat alteration from herbicide applications are not likely. The number of currently known infested acres comprises 0.003% of LAUs within the proposed action area. Conifers are largely tolerant of the herbicides proposed for both ground-based and aerial application. Indirect effects as a result of improvement of prey habitat from all invasive plant treatment methods are likely to be beneficial.

The proposed action may affect, but is not likely to adversely, and may beneficially affect Canada lynx.

Region 4 Sensitive Species

Gray Wolf

Effects would be similar as described under Alternative 2- Current Action alternative There are 13 herbicides proposed for use; one, 2,4-D, has an exposure scenario that exceeds a hazard quotient level of concern for carnivores, the effects of which are described under Alternative 2.

Effects Determination

Direct effects to wolves as a result of herbicide toxicity are unlikely. The combination of the small number of infested acres within the proposed action area and the improbability of the exposure scenario (it is not likely that a prey species would be directly sprayed by 2,4-D then preyed upon by a wolf) decreases the possibility of effects.

Indirect effects as a result of prey availability from all invasive plant treatment methods are likely to be beneficial. Overall, the treatment methods would positively influence forage for key prey species such as elk, which would result in a potential improvement in the prey base.

The proposed action may impact individual wolves, likely in a beneficial manner, but would not likely contribute to a trend towards Federal listing.

Wolverine

Effects would be similar as described under Alternative 2- Current Action alternative. There are 12 herbicides proposed for use in the upland areas; one, 2,4-D, has an exposure scenario that exceeds a hazard quotient level of concern for carnivores, the effects of which are described under Alternative 2.

Aerial application of herbicides would have the potential to have an effect on more non-target forage and cover species than more targeted ground-based application methods. There are seven herbicides proposed for aerial application;- aminopyralid, chlorsulfuron, clopyralid, imazapic, metsulfuron methyl, picloram, and sulfometuron methyl. As stated above, conifers are largely tolerant to all the herbicides proposed for aerial application. Aminopyralid and picloram can result in root uptake if applied within the drip line and aminopyralid can result in seedling mortality (Appendix I).

Volatilization is not expected to be an issue; the only herbicide proposed for use that has potential for volatilization is dicamba, which may occur from plant surfaces (Table 3-10). Drift potential of herbicides will be minimized to the extent possible using the recommendations specific to the chemical.

Effects Determination

Direct effects to wolverine as a result of herbicide toxicity are unlikely. The combination of the small number of infested acres within modeled potential habitat and the improbability of the exposure scenario (it is not likely that a prey species would be directly sprayed by 2,4-D then preyed upon by a wolverine) decreases the possibility of effects.

Indirect effects as a result of habitat alteration from herbicide applications are not likely. The number of currently known infested acres comprises 0.002% of modeled wolverine habitat within the proposed action area. Conifers are largely tolerant of the herbicides proposed for both ground-based and aerial application (Appendix I).

Indirect effects as a result of prey availability from all invasive plant treatment methods are likely to be beneficial. Overall, the treatment methods would positively influence forage for key prey species such as elk, which would result in a potential improvement in the prey base.

The proposed action may impact individual wolverines, likely in a beneficial manner, but would not likely contribute to a trend towards Federal listing.

Fisher

Effects would be similar as described under Alternative 2- Current Action alternative There are 13 herbicides proposed for use; one, 2,4-D, has an exposure scenario that exceeds a hazard quotient level of concern for carnivores, the effects of which are described under Alternative 2.

Fisher habitat has not been modeled in the SCNF. Although they have not been observed on all Districts, therefore all Invasive Plant Management Zones, lack of detection does not prove absence or presence. Utilizing the cover types of conifer and riparian across the analysis area, there are approximately 3,150 acres of known invasive plant infestations within the approximately 36,000 acres of riparian cover type and approximately 25,600 acres of known invasive plant infestations

within the approximately 1.7 million acres of conifer cover type (Appendix P). Of the known invasive plant infestations in these cover types, the top three are knapweed (83%), musk thistle (5%), and Canada thistle (4%).

Fisher habitat predominantly consists of conifer forests and forested riparian areas. Conifers are largely tolerant of the proposed herbicides at typical application rates. Common injuries to conifers include chlorosis, needle shed, needle curl, and branch die-back. Aminopyralid, dicamba, and picloram can result in root uptake if applied within the drip line. Seedlings are susceptible to injury from application of 2,4-D and seedling mortality may result for application of aminopyralid. Woody species are susceptible to imazapyr (Appendix I).

Aerial application of herbicides would have the potential to have an effect on more non-target forage and cover species than more targeted ground-based application methods. There are seven herbicides proposed for aerial application- aminopyralid, chlorsulfuron, clopyralid, imazapic, metsulfuron methyl, picloram, and sulfometuron methyl. As stated above, conifers are largely tolerant to all the herbicides proposed for aerial application. Use of aminopyralid and picloram can result in root uptake if applied within the drip line and use of aminopyralid can result in seedling mortality.

Volatilization is not expected to be an issue; the only herbicide proposed for use that has potential for volatilization is dicamba, which may occur from plant surfaces (Table 3-10). Drift potential of herbicides would be minimized to the extent possible using the recommendations specific to the chemical.

Effects Determination

Direct effects to fisher as a result of herbicide toxicity are unlikely. The combination of the small number of infested acres within modeled potential habitat and the improbability of the exposure scenario (it is not likely that a prey species would be directly sprayed by 2,4-D then preyed upon by a fisher) coupled with the very low number of occurrences of fisher in the SCNF decreases the possibility of effects.

Indirect effects as a result of habitat alteration from herbicide applications are not likely. The number of currently known infested acres comprises 0.09% of riparian cover type and 0.02% of conifer cover type within the proposed action area. Conifers are largely tolerant of the herbicides proposed.

Indirect effects as a result of prey availability from all invasive plant treatment methods are likely to be beneficial. Overall, the treatment methods would positively influence forage for key prey species, which would result in a potential improvement in the prey base.

The proposed action may impact individual fisher, likely in a beneficial manner, but would not likely contribute to a trend towards Federal listing.

Bighorn Sheep

Effects would be similar as described under Alternative 2- Current Action alternative. There are 13 herbicides proposed for use with the same effects as described under Alternative 2.

From a forage perspective, grasses and forbs, and to a lesser degree, shrubs are very important to bighorn sheep. Perennial grasses, once they are past the seedling stage, are largely tolerant of the thirteen herbicides being analyzed. Some herbicides, such as imazapyr and metsulfuron methyl, are used to control annual grasses. Most families of forbs are susceptible. Shrubs are prone to seedling mortality and injury from foliar applications.

Aerial application of herbicides would have the potential to have an effect on more non-target forage and cover species than more targeted ground-based application methods. There are seven herbicides proposed for aerial application- aminopyralid, chlorsulfuron, clopyralid, imazapic, metsulfuron methyl, picloram, and sulfometuron methyl. Perennial grasses, especially those that are past the seedling stage, are tolerant of all seven herbicides. Deciduous and evergreen shrubs seedling injury or mortality can result from the application of aminopyralid, chlorsulfuron, metsulfuron methyl, and picloram; mature shrubs are largely tolerant, although minor foliar injury such as leaf curl/cupping, chlorosis, epinasty, or defoliation could occur. Shrubs are very tolerant to applications of clopyralid and imazapic. Applications of sulfometuron methyl could result in injury or mortality of all age classes of shrubs at application rates of above one ounce per acre (Appendix I).

Since most of the target species are forbs, it is reasonable to expect that forbs are susceptible to herbicide application. The seven herbicides proposed for aerial use are selective and are used to target specific families of plants. Most native forbs are moderately tolerant to tolerant of aminopyralid and most forbs are tolerant to metsulfuron methyl, since it is used to target annual grasses. Clopyralid targets the aster/composite, legume/pea, knotweed, and nightshade families; chlorsulfuron and sulfometuron methyl target the borage, mustard/crucifer, and legume/pea families; and imazapic targets the borage, mustard/crucifer, and amaranth/goosefoot families. Many plant families are susceptible to picloram, but the aster/composite and legume/pea are especially susceptible (Appendix I).

Volatilization is not expected to be an issue; the only herbicide proposed for use that has potential for volatilization is dicamba, which may occur from plant surfaces (Table 3-10). Drift potential of herbicides would be minimized to the extent possible using the recommendations specific to the chemical.

Effects Determination

Direct effects to bighorn sheep as a result of herbicide toxicity are unlikely. The assumptions for the exposure scenarios are that in an acute scenario 100% of the diet is contaminated vegetation that was sprayed directly and in the chronic scenario the animal consumes vegetation for a 90 day period after herbicide application (consisting of 30% of the diet), or the animal eats vegetation 25 to 100 feet from the application site, but 100% of the diet is assumed to be contaminated by drift. Three of the four herbicides that had hazard quotients that exceeded a level of concern for large mammals consuming contaminated vegetation would be applied by ground-based application methods. Spot spraying is targeted and covers an area far smaller than a foraging area for a bighorn sheep. Ground- based broadcast applications would be restricted to areas near roads and would also not encompass the entirety of foraging habitat. One herbicide, picloram, is proposed for aerial application, which can cover a larger area than ground-based application. The toxicological significance of the HQ that could result at the maximum application level is relatively modest and would not be expected to result in obvious signs of toxicity.

Indirect effects from treatment methods are not expected to have a negative effect on bighorn sheep. Studies have shown that herbicide use may temporarily reduce the abundance of forb and shrub species, but that had little or no impact on the abundance of large mammalian herbivores (Sullivan and Sullivan 2003).

The amount of habitat alteration resulting from temporary decreases in forage species as a result of invasive plant treatment activities (herbicide, manual and mechanical, biological, and restoration activities) is not expected to have a noticeable effect on forage abundance. Rather, treatment activities are expected to have a long-term beneficial effect on overall forage quality and quantity.

The proposed action may impact individual bighorn sheep, likely in a beneficial manner, but would not likely contribute to a trend towards Federal listing.

Spottend andTownsend's's Big-eared Bats

Effects would be the same as described under Alternative 2- Current Action alternative.

Effects Determination

Direct effects to spotted bats as a result of herbicide toxicity are not expected. For the insect consumption scenario, bats would have to eat enough insects that were directly sprayed at the maximum application rate to give them a high enough doses to exceed the level of concern. Both herbicides are being proposed for ground-based application only, so the probability of a large enough number of insects within a bat's foraging area being contaminated is very low. The chance of a bat being directly sprayed is also very low. The very small chance of the scenarios occurring coupled with the low to moderate populations that occur in the SCNF, make impacts unlikely.

Indirect effects to their prey base are not expected. Of the two herbicides that exceeded the LOC, there is no basis to assert lethality to insects or result in adverse effects or effects would likely not be substantial of detectable. The subsequent increase of native plants that support Lepidopteran species would be expected as a result of invasive plant treatment, which could result in an increase of the prey base for this species. .

No effects are expected to as a result of biological or manual/mechanized treatment methods or cultural restoration activities.

The proposed action may impact individual spotted or Townsend's big-eared bats, likely in a beneficial manner, but would not likely contribute to a trend towards Federal listing.

Pygmy Rabbit

There are 12 herbicides proposed for use in the upland areas; one herbicide, 2,4-D, has an acute exposure scenario of a small mammal being directly sprayed, three herbicides, 2,4-D, picloram, and triclopyr have acute exposure scenarios that exceed a hazard quotient level of concern for small mammals eating contaminated vegetation; and two herbicides, picloram and triclopyr, have chronic exposure scenarios that exceed a hazard quotient level of concern for small mammals eating contaminated vegetation. These effects are described under Alternative 2.

Aerial application of herbicides would have the potential to have an effect on more non-target species than more targeted ground-based application methods. The seven herbicides proposed for aerial use are selective and are used to target specific families of plants. Most native forbs are

moderately tolerant to tolerant of aminopyralid and most forbs are tolerant to metsulfuron methyl, since it is used to target annual grasses. Imazapic does not target families identified as being especially important to sage-grouse. Clopyralid targets the aster/composite and legume/pea families; and chlorsulfuron and sulfometuron methyl target the legume/pea family. Many plant families are susceptible to picloram, but the aster/composite and legume/pea are especially susceptible (Appendix I).

Volatilization is not expected to be an issue; the only herbicide proposed for use that has potential for volatilization is dicamba, which may occur from plant surfaces (Table 3-10). Drift potential of herbicides would be minimized to the extent possible using the recommendations specific to the chemical.

Effects Determination

Direct effects to pygmy rabbits as result of herbicide toxicity are not likely to occur. The herbicides discussed above are believed to have risk estimates that overestimate potential field exposures; that adverse effects are not likely to occur; there would be no basis to assert that signs of toxicity would be observed after exposure; or the prevalence and severity of potential effects cannot be characterized. Triclopyr was the only herbicide that could result in adverse effects (to offspring). Both triclopyr and 2,4-D herbicide would be applied via ground-based methods, so application would be targeted. Picloram is being proposed for aerial application.

Habitat effects would be generally considered to be beneficial. The herbicide that is most damaging to evergreen shrubs, sulfometuron methyl, would be used situations to control annual grasses and would not be used on areas that had healthy, robust stands of sage-brush. The herbicides used in sage-grouse habitat would be selected specifically to have the greatest efficacy on the target species with the least impact to non-target species. The overarching goal of utilizing herbicides in these habitats is to reduce to invasive plant populations and enhance native herbaceous and shrub populations.

No impacts are expected to as a result of biological or manual/mechanized treatment methods or cultural restoration activities.

The proposed action may impact individual pygmy rabbits, but would not likely contribute to a trend towards Federal listing.

Bald Eagle

Effects would be the same as described under Alternative 2- Current Action alternative.

Effects Determination

Direct effects to bald eagles as result of herbicide toxicity are not likely. To address potential issues regarding direct disturbance during nesting, a design criterion specific to eagles states that no aerial herbicide application would occur within ½ mile from known bald eagle nest sites between February 1 through August 15 (or until young have fledged).

Indirect effects from habitat alteration are expected to be negligible. Applications would be targeted, since no broadcast application would occur in riparian areas, so non-target species damage would be expected to be minimal.

The proposed action is expected to have no impact on bald eagles.

Northern Goshawk

Effects would be similar as described under Alternative 2- Current Action alternative.

Goshawk habitat predominantly consists of conifer forests. Conifers are largely tolerant of the proposed herbicides at typical application rates. Common injuries to conifers include chlorosis, needle shed, needle curl, and branch die-back. Aminopyralid, dicamba, and picloram can result in root uptake if applied within the dripline. Seedlings are susceptible to injury from application of 2,4-D and seedling mortality may result for application of aminopyralid. Woody species are susceptible to imazapyr (Appendix I).

Aerial application of herbicides would have the potential to have an effect on more non-target forage and cover species than more targeted ground-based application methods. There are seven herbicides proposed for aerial application- aminopyralid, chlorsulfuron, clopyralid, imazapic, metsulfuron methyl, picloram, and sulfometuron methyl. As stated above, conifers are largely tolerant to all the herbicides proposed for aerial application. Use of aminopyralid and picloram can result in root uptake if applied within the drip line and use of aminopyralid can result in seedling mortality (Appendix I).

Volatilization is not expected to be an issue; the only herbicide proposed for use that has potential for volatilization is dicamba, which may occur from plant surfaces (Table 3-10). Drift potential of herbicides would be minimized to the extent possible using the recommendations specific to the chemical.

Effects Determination

Direct effects to goshawks as result of herbicide toxicity are not likely. To address potential issues regarding direct disturbance during nesting, a design criterion specific to goshawks states that no aerial herbicide application would occur within ½ mile from known nest sites between April 1 through August 31 (or until young have fledged).

Indirect effects as a result of habitat alteration from herbicide applications are not likely. The number of currently known infested acres comprises 0.02% of conifer cover type within the proposed action area. Conifers are largely tolerant of the herbicides proposed.

Indirect effects as a result of prey availability from all invasive plant treatment methods are likely to be beneficial. Overall, the treatment methods would positively influence forage for key prey species such as passerine birds and small mammals, which would result in a potential improvement in the prey base.

The proposed action may impact individual goshawks, likely in a beneficial manner, but would not likely contribute to a trend towards Federal listing.

American Peregrine Falcon

Effects would be similar as described under Alternative 2- Current Action alternative.

Deciduous trees and shrubs, which are an important habitat component for prey species, are largely tolerant of the herbicides proposed for use in riparian areas at application rates used for forbs.

Injury, such as leaf cupping or curling, chlorosis, and/or potential defoliation, as well as injury or mortality for seedlings could occur. Deciduous woody species are more susceptible to injury or death from two herbicides, imazapyr and sulfometuron methyl (Appendix I).

There would be no broadcast application in riparian areas, and no applications would occur if sustained wind speeds exceed 5 mph or label directions in order to prevent drift and damage to non-target riparian plant species.

Effects Determination

Direct effects to peregrine falcons as result of herbicide toxicity are not likely. To address potential issues regarding direct disturbance during nesting, a design criterion specific to peregrine falcons states that no aerial herbicide application would occur within ½ mile from known nest sites between April 1 through August 31 (or until young have fledged).

Indirect effects as a result of prey availability from all invasive plant treatment methods are likely to be beneficial. Overall, the treatment methods would positively influence forage for key prey species such as passerine birds, which would result in a potential improvement in the prey base.

The proposed action may impact individual peregrine falcons, likely in a beneficial manner, but would not likely contribute to a trend towards Federal listing.

Boreal Owl

Effects would be similar as described under Alternative 2- Current Action alternative.

Boreal owl habitat predominantly consists of conifer forests. Conifers are largely tolerant of the proposed herbicides at typical application rates. Common injuries to conifers include chlorosis, needle shed, needle curl, and branch die-back. Aminopyralid, dicamba, and picloram can result in root uptake if applied within the drip line. Seedlings are susceptible to injury from application of 2,4-D and seedling mortality may result for application of aminopyralid. Woody species are susceptible to imazapyr (Appendix I).

Aerial application of herbicides would have the potential to have an effect on more non-target forage and cover species than more targeted ground-based application methods. There are seven herbicides proposed for aerial application- aminopyralid, chlorsulfuron, clopyralid, imazapic, metsulfuron methyl, picloram, and sulfometuron methyl. As stated above, conifers are largely tolerant to all the herbicides proposed for aerial application. Use of aminopyralid and picloram can result in root uptake if applied within the drip line and use of aminopyralid can result in seedling mortality (Appendix I).

Volatilization is not expected to be an issue; the only herbicide proposed for use that has potential for volatilization is dicamba, which may occur from plant surfaces (Table 3-10). Drift potential of herbicides would be minimized to the extent possible using the recommendations specific to the chemical.

Effects Determination

Direct effects to boreal owls as a result of herbicide toxicity are not expected. No hazard quotients were exceeded for the consumption of mammalian or avian prey. For the insect consumption scenario, owls would have to eat enough insects that were directly sprayed at the maximum

application rate to give them a high enough doses to exceed the level of concern. All three herbicides are being proposed for ground-based application only, so the probability of a large enough number of insects within an owl's foraging area being contaminated is very low. The very small chance of the scenarios occurring coupled with the low populations that occur in the SCNF, make impacts unlikely.

Indirect effects as a result of habitat alteration from herbicide applications are not likely. The number of currently known infested acres comprises 0.02% of conifer cover type within the proposed action area. Conifers are largely tolerant of the herbicides proposed for both ground-based and aerial application.

Indirect effects as a result of prey availability from all invasive plant treatment methods are likely to be beneficial. Overall, the treatment methods would positively influence forage for key prey species such as passerine birds, small mammals, and insects, which would result in a potential improvement in the prey base.

The proposed action may impact individual boreal owls, likely in a beneficial manner, but would not likely contribute to a trend towards Federal listing.

Flammulated Owl and Three-toed Woodpecker

Effects would be similar as described under Alternative 2- Current Action alternative.

Flammulated owl and three-toed woodpecker habitat predominantly consists of conifer forests. Conifers are largely tolerant of the proposed herbicides at typical application rates. Common injuries to conifers include chlorosis, needle shed, needle curl, and branch die-back. Aminopyralid, dicamba, and picloram can result in root uptake if applied within the drip line. Seedlings are susceptible to injury from application of 2,4-D and seedling mortality may result for application of aminopyralid. Woody species are susceptible to imazapyr (Appendix I).

Aerial application of herbicides would have the potential to have an effect on more non-target forage and cover species than more targeted ground-based application methods. There are seven herbicides proposed for aerial application- aminopyralid, chlorsulfuron, clopyralid, imazapic, metsulfuron methyl, picloram, and sulfometuron methyl. As stated above, conifers are largely tolerant to all the herbicides proposed for aerial application. Use of aminopyralid and picloram can result in root uptake if applied within the drip line and use of aminopyralid can result in seedling mortality (Appendix I).

Volatilization is not expected to be an issue; the only herbicide proposed for use that has potential for volatilization is dicamba, which may occur from plant surfaces (Table 3-10). Drift potential of herbicides would be minimized to the extent possible using the recommendations specific to the chemical.

Effects Determination

Direct effects to flammulated owls and three-toed woodpeckers as a result of herbicide toxicity are not expected. For the insect consumption scenario, owls and woodpeckers would have to eat enough insects that were directly sprayed at the maximum application rate to give them a high enough doses to exceed the level of concern. All three herbicides are being proposed for ground-based application only, so the probability of a large enough number of insects within an owl's and woodpecker's foraging area being contaminated is very low. The very small chance of the scenarios occurring makes impacts unlikely.

Indirect effects as a result of habitat alteration from herbicide applications are not likely. The number of currently known infested acres comprises 0.02% of conifer cover type within the proposed action area. Conifers are largely tolerant of the herbicides proposed for both ground-based and aerial application.

Indirect effects as a result of prey availability from all invasive plant treatment methods are likely to be beneficial. Overall, the treatment methods would positively influence forage for key prey species such as insects; which would result in a potential improvement in the prey base.

The proposed action may impact individual flammulated owls or three-toed woodpeckers, likely in a beneficial manner, but would not likely contribute to a trend towards Federal listing.

Great Gray Owl

Effects would be similar as described under Alternative 2- Current Action alternative.

Great grey owl habitat predominantly consists of conifer forests and open meadows. Conifers are largely tolerant of the proposed herbicides at typical application rates. Common injuries to conifers include chlorosis, needle shed, needle curl, and branch die-back. Aminopyralid, dicamba, and picloram can result in root uptake if applied within the drip line. Seedlings are susceptible to injury from application of 2,4-D and seedling mortality may result for application of aminopyralid. Woody species are susceptible to imazapyr (Appendix I).

Aerial application of herbicides would have the potential to have an effect on more non-target forage and cover species than more targeted ground-based application methods. There are seven herbicides proposed for aerial application-aminopyralid, chlorsulfuron, clopyralid, imazapic, metsulfuron methyl, picloram, and sulfometuron methyl. As stated above, conifers are largely tolerant to all the herbicides proposed for aerial application. Use of aminopyralid and picloram can result in root uptake if applied within the drip line and use of aminopyralid can result in seedling mortality (Appendix I).

There would be no broadcast application in riparian areas, and no applications would occur if sustained wind speeds exceed 5 mph or label directions in order to prevent drift and damage to non-target riparian plant species.

Volatilization is not expected to be an issue; the only herbicide proposed for use that has potential for volatilization is dicamba, which may occur from plant surfaces (Table 3-10). Drift potential of herbicides would be minimized to the extent possible using the recommendations specific to the chemical.

Effects Determination

Indirect effects as a result of prey availability from all invasive plant treatment methods are likely to be beneficial. Overall, the treatment methods would positively influence forage for key prey species such as small mammals, which would result in a potential improvement in the prey base.

The proposed action may impact individual great grey owls, likely in a beneficial manner, but would not likely contribute to a trend towards Federal listing.

Harlequin Duck

Effects would be similar as described under Alternative 2- Current Action alternative.

Six of the herbicides proposed for use in riparian areas had no exposure scenarios that exceed a hazard quotient for birds. Two, clopyralid and imazapyr, had scenarios that had hazard quotients that exceeded levels of concern for birds consuming vegetation of a long period of time. That would not apply to harlequin ducks, since they are primarily invertivores. One herbicide, triclopyr, did have a modest exceedance of the upper bound HQ of 0.3 (range of 0.02 to 1.8) for the scenario of a small bird consuming contaminated insects. Again, that may not apply to harlequin ducks. Aquatic applications, both submergent and emergent, of triclopyr did not lead to HQs that exceeded any LOC for aquatic invertebrates (SERA 2011).

Deciduous trees and shrubs, which are an important habitat component for this species, are largely tolerant of the herbicides proposed for use in riparian areas at application rates used for forbs. Injury, such as leaf cupping or curling, chlorosis, and/or potential defoliation, as well as injury or mortality for seedlings could occur. Deciduous woody species are more susceptible to injury or death from two herbicides, imazapyr and sulfometuron methyl (Appendix I). There would be no broadcast application in riparian areas, and no applications would occur if sustained wind speeds exceed 5 mph or label directions in order to prevent drift and damage to non-target riparian plant species.

Effects Determination

Direct effects to harlequin ducks as result of herbicide toxicity are unlikely. The one herbicide, triclopyr, which had a scenario of birds consuming contaminated insects that slightly exceeded the upper bound HQ, is an herbicide that is rarely used (Table 3-49). The anticipated low use of the herbicide combined with the very low number of sightings of the species, decreases the possibility of effects.

Indirect effects from habitat alteration are also expected to be negligible. Of the nine herbicides that are proposed for use in riparian areas, deciduous woody species are susceptible to two of them. Applications would be targeted, since no broadcast application would occur in riparian areas, so non-target species damage would be expected to be minimal.

In aquatic applications, algae would be largely unaffected by herbicide treatments. Macrophytes, which are important habitat components for the invertebrates that make up the diet of harlequin ducks, have the potential to be negatively affected by herbicide treatments. However, those effects would be relatively short-term and anticipated to be offset by the eradication or reduction of invasive target species.

No effects are expected to as a result of biological or manual/mechanized treatment methods or cultural restoration activities. The proposed action may impact individual harlequin ducks, likely in a beneficial manner, but would not likely contribute to a trend towards Federal listing.

Management Indicator Species

Pileated Woodpecker

Effects would be similar as described under Alternative 2- Current Action alternative.

Pileated woodpecker habitat predominantly consists of conifer forests. Conifers are largely tolerant of the proposed herbicides at typical application rates. Common injuries to conifers include chlorosis, needle shed, needle curl, and branch die-back. Aminopyralid, dicamba, and picloram can result in root uptake if applied within the drip line. Seedlings are susceptible to injury from application of 2,4-D and seedling mortality may result for application of aminopyralid. Woody species are susceptible to imazapyr (Appendix I).

Aerial application of herbicides would have the potential to have an effect on more non-target forage and cover species than more targeted ground-based application methods. There are seven herbicides proposed for aerial application- aminopyralid, chlorsulfuron, clopyralid, imazapic, metsulfuron methyl, picloram, and sulfometuron methyl. As stated above, conifers are largely tolerant to all the herbicides proposed for aerial application. Use of aminopyralid and picloram can result in root uptake if applied within the drip line and use of aminopyralid can result in seedling mortality (Appendix I).

Volatilization is not expected to be an issue; the only herbicide proposed for use that has potential for volatilization is dicamba, which may occur from plant surfaces (Table 3-10). Drift potential of herbicides would be minimized to the extent possible using the recommendations specific to the chemical.

Effects Determination

Direct effects to pileated woodpeckers as a result of herbicide toxicity are not expected. For the insect consumption scenario, woodpeckers would have to eat enough insects that were directly sprayed at the maximum application rate to give them a high enough doses to exceed the level of concern. All three herbicides are being proposed for ground-based application only, so the probability of a large enough number of insects within a woodpecker's foraging area being contaminated is very low. The very small chance of the scenarios occurring makes impacts unlikely.

Indirect effects as a result of habitat alteration from herbicide applications are not likely. The number of currently known infested acres comprises 0.01% of conifer cover type within the proposed action area. Conifers are largely tolerant of the herbicides proposed for both ground-based and aerial application.

Indirect effects as a result of prey availability from all invasive plant treatment methods are likely to be beneficial. Overall, the treatment methods would positively influence forage for key prey species such as insects; which would result in a potential improvement in the prey base.

The proposed action would not cause a loss of viability to the population or species or be expected to result in a downward trend for pileated woodpeckers.

Greater Sage-grouse

Effects would be similar as described under Alternative 2- Current Action alternative. Of the 13 herbicides proposed for use in the SCNF, two herbicides, dicamba and picloram, have acute exposure scenarios that exceed a hazard quotient level of concern for birds eating contaminated vegetation; three herbicides, 2,4-D, dicamba, and triclopyr, exceed the HQ LOC for the acute exposure scenario of birds consuming contaminated insects; and three herbicides, clopyralid, imazapyr, and picloram, have chronic exposure scenarios that exceed a hazard quotient level of concern for birds eating contaminated vegetation. Effects for all the herbicides, except imazapyr, are described under Alternative 2.

Imazapyr is practically non-toxic to birds and terrestrial invertebrates. One chronic exposure scenario for birds, consumption of contaminated grass, had a HQ of 1.4 which modestly exceeds the LOC (1.0). There is no basis to assert that signs of toxicity would be observed in birds after exposure to imazapyr (SERA 2011).

From a habitat and forage perspective, sagebrush, forbs (especially those in the composite family), and grasses are important to sage-grouse. Perennial grasses, once they are past the seedling stage, are largely tolerant of the thirteen herbicides being analyzed. Some herbicides, such as imazapyr, imazapic, metsulfuron methyl, and sulfometuron methyl are used to control annual grasses. The use of pre-emergent herbicides to control annual grasses such as cheatgrass is recommended as a sage-grouse habitat management guideline (Connelly et al. 2000).

Evergreen shrub seedling injury or mortality can result from the application of 2,4-D, aminopyralid, chlorsulfuron, dicamba, metsulfuron methyl, and picloram; mature shrubs are largely tolerant, although minor foliar injury such as leaf curl/cupping, chlorosis, epinasty, or defoliation could occur. Shrubs are very tolerant to applications of clopyralid and imazapic. Applications of sulfometuron methyl could result in injury or mortality of all age classes of shrubs at application rates of above one ounce per acre (Appendix I).

Since most of the target species are forbs, it is reasonable to expect that forbs are susceptible to herbicide application. All forb families are susceptible to 2,4-D to some degree and most forb families are susceptible to dicamba, glyphosate, and imazapyr. The legume/pea (Fabaceae) family is susceptible to chlorsulfuron, clopyralid, dicamba, picloram, sulfometuron methyl, and triclopyr. The aster/composite (Asteraceae) family is susceptible to clopyralid and picloram, yet is tolerant to chlorsulfuron, imazapic, sulfometuron methyl, and triclopyr. Most native forbs are tolerant to aminopyralid and most forb families are not susceptible to imazapic and metsulfuron methyl (Appendix I).

Aerial application of herbicides would have the potential to have an effect on more non-target species than more targeted ground-based application methods. The seven herbicides proposed for use are selective and are used to target specific families of plants. Most native forbs are moderately tolerant to tolerant of aminopyralid and most forbs are tolerant to metsulfuron methyl, since it is used to target annual grasses. Imazapic does not target families identified as being especially important to sage-grouse. Clopyralid targets the aster/composite and legume/pea families; and chlorsulfuron and sulfometuron methyl target the legume/pea family. Many plant families are susceptible to picloram, but the aster/composite and legume/pea are especially susceptible (Appendix I).

Volatilization is not expected to be an issue; the only herbicide proposed for use that has potential for volatilization is dicamba, which may occur from plant surfaces (Table 3-10). Drift potential of herbicides would be minimized to the extent possible using the recommendations specific to the chemical.

Effects Determination

Direct effects to sage-grouse as result of herbicide toxicity are unlikely to occur. The herbicides discussed above are believed to have risk estimates that overestimate potential field exposures; that adverse effects are not likely to occur; there would be no basis to assert that signs of toxicity would be observed after exposure; or the prevalence and severity of potential effects cannot be characterized. Dicamba was the only herbicide that could result in adverse effects (to offspring). The proportion of potential habitat that dicamba could be used on is very low (0.002% of the potential habitat and 0.005% of the seasonal breeding and brood rearing habitat). A design criterion specific to sage-grouse is that no aerial application would occur within known or potential sage-grouse nesting/early brood-rearing habitat until after June 30 to prevent any potential impacts to nesting hens or chicks.

Indirect effects resulting from a decrease in insect availability are not expected. The risk assessments for both herbicides that had LOC exceeded for honeybees (as a surrogate for other terrestrial insects) concluded that effects would likely not be substantial or detectable or there is no basis to assert that direct spray would be likely to be lethal to insects or result in any adverse effects.

Habitat effects would be generally considered to be beneficial. The herbicide that is most damaging to evergreen shrubs, sulfometuron methyl, would be used situations to control annual grasses and would not be used on areas that had healthy, robust stands of sage-brush. The herbicides used in sage-grouse habitat would be selected specifically to have the greatest efficacy on the target species with the least impact to non-target species. The overarching goal of utilizing herbicides in these habitats is to reduce to invasive plant populations and enhance native herbaceous and shrub populations.

No impacts are expected to as a result of biological or manual/mechanized treatment methods or cultural restoration activities.

The proposed action may impact individual sage-grouse, but would not likely contribute to a trend towards Federal listing, or cause a loss of viability to the population or species or be expected to result in a downward trend for this species.

Columbia Spotted Frog

There are 3,150 acres of currently identified invasive plant infestations in the approximately 36,000 acres of riparian cover type (Appendix P). None of the herbicides proposed for use in riparian areas or for aquatic use had exposure scenarios that exceed a hazard quotient for amphibians. Perennial terrestrial grasses, once they are past the seedling stage, are largely tolerant of the herbicides being analyzed for use in riparian areas and for aquatic use. Some herbicides, such as imazapyr and metsulfuron methyl, are used to control annual grasses.

Since most of the target species are terrestrial forbs, it is reasonable to expect that forbs are susceptible to herbicide application. Most native forbs are moderately tolerant to tolerant of

aminopyralid and most forbs are tolerant to metsulfuron methyl, since it is used to target annual grasses. Clopyralid targets the aster/composite, legume/pea, knotweed/buckwheat, and nightshade families; chlorsulfuron and sulfometuron methyl; and triclopyr target the borage, mustard/crucifer, and legume/pea families. Many plant families are susceptible to 2,4-D and glyphosate, but actively growing plants will tolerate some injury at low application rates and no injury would occur to dormant plants. Most forbs are susceptible to imazapyr (Appendix I).

There are four herbicides- glyphosate, imazamox, imazapyr, and triclopyr- proposed for use in aquatic settings. Long-term adverse effects to algal species are not anticipated from any of the herbicides. Aquatic grasses are not susceptible to triclopyr; the other three herbicides may result in damage or grass mortality, but damage to tolerant species would be temporary.

Aquatic macrophytes are susceptible to all the aquatic use herbicides, which is reasonable since most of the target aquatic species are macrophytes. Damage includes reduced shoot and root growth, curling, chlorosis, necrosis, and plant mortality. Generally, there would be no damage to submerged vegetation, only to emergent or floating vegetation.

Effects Determination

Direct effects to spotted frogs as result of herbicide toxicity are not likely to occur, since none of the herbicides exceeded any thresholds that may indicate potential harm. Indirect effects from habitat alteration are expected to be minimal. Terrestrial grasses are largely tolerant and forb susceptibility caries; however, applications would be targeted, since no broadcast application would occur in riparian areas, so non-target species damage would be expected to be nominal.

In aquatic applications, algae would be largely unaffected by herbicide treatments. Macrophytes are important habitat components that have the potential to be negatively affected by herbicide treatments. However, those effects would be relatively short-term and anticipated to be offset by the eradication or reduction of invasive target species.

The proposed action may impact individual Columbia spotted frogs, but would not likely contribute to a trend towards Federal listing, or cause a loss of viability to the population or species or be expected to result in a downward trend for this species.

Migratory Breeding Birds

Effects would be similar as described under Alternative 2- Current Action alternative. Of the 13 herbicides proposed for use in the SCNF, six herbicides had exposure scenarios for birds that exceed HQ levels of concern. Two herbicides, dicamba and picloram, have acute exposure scenarios that exceed a hazard quotient level of concern for birds eating contaminated vegetation; three herbicides, 2,4-D, dicamba, triclopyr, exceed the HQ LOC for the acute exposure scenario of birds consuming contaminated insects; and three herbicides, clopyralid, imazapyr, and picloram, have chronic exposure scenarios that exceed a hazard quotient level of concern for birds eating contaminated vegetation. Effects for all the herbicides, except imazapyr, are described under Alternative 2.

Imazapyr is practically non-toxic to birds and terrestrial invertebrates. One chronic exposure scenario for birds, consumption of contaminated grass, had a HQ of 1.4 which modestly exceeds the

LOC. There is no basis to assert that signs of toxicity would be observed in birds after exposure to imazapyr (SERA 2011).

Conifers are largely tolerant of the proposed herbicides at typical application rates. Common injuries to conifers include chlorosis, needle shed, needle curl, and branch die-back. Aminopyralid, dicamba, and picloram can result in root uptake if applied within the drip line. Seedlings are susceptible to injury from application of 2,4-D and seedling mortality may result from application of aminopyralid. Woody species are susceptible to imazapyr (Appendix I).

Aerial application of herbicides would have the potential to have an effect on more non-target forage and cover species than more targeted ground-based application methods. There are seven herbicides proposed for aerial application- aminopyralid, chlorsulfuron, clopyralid, imazapic, metsulfuron methyl, picloram, and sulfometuron methyl. As stated above, conifers are largely tolerant to all the herbicides proposed for aerial application. Use of aminopyralid and picloram can result in root uptake if applied within the drip line and use of aminopyralid can result in seedling mortality (Appendix I).

Deciduous trees and shrubs, which are an important habitat component for this species, are largely tolerant of the herbicides proposed for use in riparian areas at application rates used for forbs. Injury, such as leaf cupping or curling, chlorosis, and/or potential defoliation, as well as injury or mortality for seedlings could occur. Deciduous woody species are more susceptible to injury or death from two herbicides, imazapyr and sulfometuron methyl. There would be no broadcast application in riparian areas, and no applications would occur if sustained wind speeds exceed 5 mph or label directions in order to prevent drift and damage to non-target riparian plant species.

Evergreen shrub seedling injury or mortality can result from the application of 2,4-D, aminopyralid, chlorsulfuron, dicamba, metsulfuron methyl, and picloram; mature shrubs are largely tolerant, although minor foliar injury such as leaf curl/cupping, chlorosis, epinasty, or defoliation could occur. Shrubs are very tolerant to applications of clopyralid and imazapic. Applications of sulfometuron methyl could result in injury or mortality of all age classes of shrubs at application rates of above one ounce per acre (Appendix I).

Perennial grasses, once they are past the seedling stage, are largely tolerant of the thirteen herbicides being analyzed. Some herbicides, such as imazapyr, imazapic, metsulfuron methyl, and sulfometuron methyl are used to control annual grasses.

Since most of the target species are forbs, it is reasonable to expect that forbs are susceptible to herbicide application. The seven herbicides proposed for aerial use are selective and are used to target specific families of plants. Most native forbs are moderately tolerant to tolerant of aminopyralid and most forbs are tolerant to metsulfuron methyl, since it is used to target annual grasses. Clopyralid targets the aster/composite, legume/pea, knotweed, and nightshade families; chlorsulfuron , sulfometuron methyl, and triclopyr target the borage, mustard/crucifer, and legume/pea families; and imazapic targets the borage, mustard/crucifer, and amaranth/goosefoot families. Many plant families are susceptible to picloram, but the aster/composite and legume/pea are especially susceptible. Most forb families are susceptible to dicamba, but the legume/pea is especially susceptible. Many plant families are susceptible to 2,4-D and glyphosate, but actively growing plants will tolerate some injury at low application rates and no injury would occur to dormant plants. Most forbs are susceptible to imazapyr (Appendix I).

There are four herbicides- glyphosate, imazamox, imazapyr, and triclopyr- that are proposed for use in aquatic settings. Long-term adverse effects to algal species are not anticipated from any of the herbicides. Aquatic grasses are not susceptible to triclopyr; the other three herbicides may result in damage or grass mortality, but damage to tolerant species would be temporary.

Aquatic macrophytes are susceptible to all the aquatic use herbicides, which is reasonable since most of the target aquatic species are macrophytes. Damage includes reduced shoot and root growth, curling, chlorosis, necrosis, and plant mortality. Generally there would be no damage to submerged vegetation, only to emergent or floating vegetation.

Effects Determination

Direct effects to migratory birds as result of herbicide toxicity are not likely to occur. The herbicides discussed above are believed to have risk estimates that overestimate potential field exposures; that adverse effects are not likely to occur; there would be no basis to assert that signs of toxicity would be observed after exposure; or the prevalence and severity of potential effects cannot be characterized. Dicamba was the only herbicide that could result in adverse effects (to offspring). For picloram, adverse effects may not be ruled out, but prevalence and severity of effects cannot be characterized.

A design criterion specific to raptors is that sites within ¼ mile of active raptor nests would not be treated with broadcast methods until young fledge. Other design criteria for herbicide application would ensure herbicides would be applied safely and appropriately.

Indirect effects from treatment methods are not expected to have a long-term negative effect on migratory birds. Studies that looked at the aerial application of glyphosate to control brush found that the treatments resulted in vegetation that was structurally less complex and a reduction in abundance of invertebrates. Birds that used shrub habitat for foraging and nesting declined in abundance post-treatment, more so than species that tended to be habitat generalists (Morrison and Meslow 1984, Santillo et al. 1989). Once the vegetation recovered from the herbicide treatment, bird abundance increased (Morrison and Meslow 1984). The use of selective herbicide in shrub habitats did not affect nesting success of population density (Marshall and Vandruff 2002).

The proposed maximum acres of herbicide treatment that could occur annually, 16,000 acres, comprise 0.005% of the action area. The proposed maximum acres of all treatments that could occur annually, 20,000 acres, comprise 0.006% of the action area. The amount of habitat alteration resulting from temporary decreases in forage species as a result of invasive plant treatment activities (herbicide, manual and mechanical, biological, and restoration activities) is not expected to have a noticeable effect on nesting or roosting habitat or forage abundance. Rather, treatment activities are expected to have a long-term beneficial effect on overall habitat quality and quantity.

Ungulates-Elk

Effects would be similar as described under Alternative 2- Current Action alternative. Of the thirteen herbicides that are being analyzed for use, four had hazard quotients (HQs) that exceeded the level of concern (LOC) for the scenario of large mammals consuming contaminated vegetation. Three herbicides, 2,4-D, dicamba, and triclopyr, had acute scenarios that had HQs that exceeded levels of concern, and three, 2,4-D, picloram, and triclopyr, had chronic scenarios that had HQs that exceeded levels of concern. Effects for all the herbicides are described under Alternative 2.

From a forage perspective, grasses and forbs, and to a lesser degree, shrubs, are very important to elk. Perennial grasses, once they are past the seedling stage, are largely tolerant of the thirteen herbicides being analyzed. Some herbicides, such as imazapyr and metsulfuron methyl, are used to control annual grasses. Most families of forbs are susceptible. Shrubs are prone to seedling mortality and injury from foliar applications.

Aerial application of herbicides would have the potential to have an effect on more non-target forage and cover species than more targeted ground-based application methods. There are seven herbicides proposed for aerial application; aminopyralid, chlorsulfuron, clopyralid, imazapic, metsulfuron methyl, picloram, and sulfometuron methyl. Perennial grasses, especially those that are past the seedling stage, are tolerant of all seven herbicides. Deciduous and evergreen shrubs seedling injury or mortality can result from the application of aminopyralid, chlorsulfuron, metsulfuron methyl, and picloram; mature shrubs are largely tolerant, although minor foliar injury such as leaf curl/cupping, chlorosis, epinasty, or defoliation could occur. Shrubs are very tolerant to applications of clopyralid and imazapic. Applications of sulfometuron methyl could result in injury or mortality of all age classes of shrubs at application rates of above one ounce per acre (Appendix I).

Since most of the target species are forbs, it is reasonable to expect that forbs are susceptible to herbicide application. The seven herbicides proposed for aerial use are selective and are used to target specific families of plants. Most native forbs are moderately tolerant to tolerant of aminopyralid and most forbs are tolerant to metsulfuron methyl, since it is used to target annual grasses. Clopyralid targets the aster/composite, legume/pea, knotweed, and nightshade families; chlorsulfuron and sulfometuron methyl target the borage, mustard/crucifer, and legume/pea families; and imazapic targets the borage, mustard/crucifer, and amaranth/goosefoot families. Many plant families are susceptible to picloram, but the aster/composite and legume/pea are especially susceptible (Appendix I).

Volatilization is not expected to be an issue; the only herbicide proposed for use that has potential for volatilization is dicamba, which may occur from plant surfaces (Table 3-10). Drift potential of herbicides would be minimized to the extent possible using the recommendations specific to the chemical.

Effects Determination

Direct effects to elk as a result of herbicide toxicity are unlikely. The assumptions for the exposure scenarios are that in an acute scenario 100% of the diet is contaminated vegetation that was sprayed directly and in the chronic scenario the animal consumes vegetation for a 90 day period after herbicide application (consisting of 30% of the diet), or the animal eats vegetation 25 to 100 feet from the application site, but 100% of the diet is assumed to be contaminated by drift. Three of the four herbicides that had hazard quotients that exceeded a level of concern for large mammals consuming contaminated vegetation would be applied by ground-based application methods. Spot spraying is targeted and covers an area far smaller than a foraging area for an elk. Ground-based broadcast applications would be restricted to areas near roads and would not encompass the entirety of foraging habitat for elk. One herbicide, picloram, is proposed for aerial application, which can cover a larger area than ground-based application. The toxicological significance of the HQ that could result at the maximum application level is relatively modest and would not be expected to result in obvious signs of toxicity.

Indirect effects from treatment methods are not expected to have a negative effect on elk. Studies have shown that herbicide use may temporarily reduce the abundance of forb and shrub species, but that had little or no impact on the abundance of large mammalian herbivores (Sullivan and Sullivan 2003). Elk preferred foraging in areas that had invasive plants removed as a result of herbicide treatment over areas that had no treatment (Thompson 1996).

The proposed maximum acres of herbicide treatment that could occur annually, 16,000 acres, comprise 0.005% of the action area. The proposed maximum acres of all treatments that could occur annually, 20,000 acres, comprise 0.006% of the action area. The amount of habitat alteration resulting from temporary decreases in forage species as a result of invasive plant treatment activities (herbicide, manual and mechanical, biological, and restoration activities) is not expected to have a noticeable effect on forage abundance. Rather, treatment activities are expected to have a long-term beneficial effect on overall forage quality and quantity.

3.5.7.4. Alternative 4-No Aerial Herbicide Application

Direct and Indirect Effects

The effects of this alternative to all the analyzed terrestrial wildlife species would be very similar to those disclosed in Alternative 3. The primary difference would be that fewer acres would be able to be treated with herbicide with likely result being not as much habitat improvement occurring. Infestations which are exceedingly difficult to access by foot or vehicle and/or wide-spread infestations that cover a large geographic area would be logistically or practically impossible to manage and would continue to spread with little or no management actions taken.

3.5.7.5. Alternative 5-No Aquatic Herbicide Application

Direct and Indirect Effects

The effects of this alternative to all the analyzed terrestrial wildlife species would be very similar to those disclosed in Alternative 3. This alternative would severely limit the ability to respond to a detection of invasive aquatic plant species. Given the rate of spread of these species and the number of vectors possible to move the species to another location, it is probable that an aquatic plant, if introduced and not eradicated soon after detection, could become established. The subsequent result would be diminished aquatic habitat quality, reduced water quality, and changes in trophic interactions.

3.5.7.6. Cumulative Effects for All Action Alternatives

Cumulative effects are “the incremental impacts of the proposed action and alternatives when added to effects of other actions both on National Forest System lands and other adjacent federal, state, or private lands” (40 CFR 1508.7).

CEQ regulations do not require the consideration of the individual effects of all past actions to determine the present effects of past actions. In regard to past actions, the agency must determine what information regarding past actions is useful and relevant to the required analysis of cumulative effects during the scoping process and the preparation of the analysis. Dependent upon the proposed action, the accounting for past actions and specific information about the direct and indirect effects of their design and implementation could, in some contexts, be useful to predict the

cumulative effects of the proposal. The CEQ regulations, however, do not require agencies to comprehensively list and analyze all individual past actions. Just because information about past actions may be available or obtained with reasonable effort does not mean that it is relevant and necessary to inform decision making (40 CFR 1508.7).

Human activities are known to have influenced the spread of invasive plants into North America, the Pacific Northwest and specific sites within the project area. A complete list of past actions is not necessary to understand how land uses have contributed to the current distribution of invasive plants. The baseline for cumulative effects analysis is the current condition.

A list of ongoing activities and foreseeable future projects are available in Appendix H. Many of these activities have the potential to introduce or spread noxious invasive plants. Permitted activities have stipulations, such as prevention measures included in grazing allotment annual operating instructions, timber sale contracts, and mineral material plans of operation. The recent update of the SCNF travel management plan eliminated cross country motorized travel, which eliminated a substantial potential for introducing or spreading noxious The acres of wildfire illustrate the disturbed acres that have the potential for noxious plant invasion. Although the possibility for the increase of infestations (i.e. wildfire) as well as for the decrease (i.e. elimination of cross country motorized travel) exists for virtually any activity that occurs in the SCNF, the maximum number of acres that would be treated- which are identified in the alternatives- would not change based upon these activities. The potential for cumulative effects resulting from treatment activities are discussed below.

Biological Treatments

No direct or indirect health effects are anticipated to occur as a result of biological treatments. Biological treatments used in conjunction with treatment methods that neighboring land management agencies, landowners, and CWMA partners implement may serve to increase the efficacy of treatments which could result in beneficial cumulative impacts to wildlife habitat. No cumulative adverse effects are anticipated to occur.

Manual and Mechanical Treatments

There is no data that identifies the level of manual and mechanical treatments that are conducted in the counties that encompass the proposed project area. Any that do occur would be at a very small scale but would be beneficial to habitat conditions in a limited area. Due to the scale, no direct or indirect effects are anticipated to occur; therefore, no adverse cumulative effects are anticipated to occur.

Chemical Treatments

Because of the manner in which the State of Idaho collects data regarding pesticide use, it is not possible to track which herbicides are used or in what quantity on private land. However, CWMA partners do track that information as it relates to their activities. Table 3-8 displays the three-year average of applied acres of herbicide in Butte, Custer, and Lemhi Counties. Table 3-6 displays the three-year average of applied acres herbicide use on the Salmon-Challis portion of the Frank Church-River of No Return Wilderness Area (FC-RONR). The County CWMAs treat private, state, county and federally owned lands and provide herbicide to land owners. The numbers below display the acres of herbicide that were applied by the County CWMAs, not acres that were applied by private

landowners. CWMA partners are licensed pesticide applicators, therefore herbicides were applied in compliance with label direction.

The SERA risk assessments identified connected actions and cumulative effects for each of the herbicides reviewed. In the risk assessments, connected actions include actions or the use of other chemicals which are necessary and in close association with the use of the analyzed herbicide. Cumulative effects are analyzed within the context of the Food Quality Protection Act, which requires the assessment of chemicals with a similar mode of action. It is beyond the scope of the risk assessments to identify and consider all agents that might interact with or cause cumulative effects with the analyzed herbicide.

2,4-D

Some studies suggest that 2,4-D in combination with other herbicides may cause synergistic effects. One study implicated 2,4-D in combination with picloram may cause reproductive impairment in mice. There is no evidence that inert compounds or impurities found in 2,4-D formulations would have a significant health risk (USDA Forest Service 2006).

2,4-D is a member of the alkylphenoxy herbicide class of pesticides. The EPA has not yet made a determination as to which compounds to which humans may be exposed, if any, have a common mode of toxicity. Interactions are likely to occur between 2, 4-D and other chemicals that affect cell membranes and cell metabolism. The risk assessment for long-term exposure, which addresses the potential impacts of cumulative effects, identified the potential for adverse effects for large mammals consuming contaminated vegetation (USDA Forest Service 2006).

Aminopyralid

There is no basis to assert that impurities in or metabolites of aminopyralid are likely to result in effects not already included in the hazard quotients for exposure scenarios.

The EPA has not made a common mechanism of toxicity finding for aminopyralid or any other substances. The risk assessment specifically considered the effects of repeated and long-term exposure, which address the potential impact of cumulative effects, and concluded that there was no basis for asserting that cumulative adverse effects were plausible (SERA 2007a).

Chlorsulfuron

There is no data to assess whether chlorsulfuron will interact either synergistically or antagonistically with 2,4-D or any other herbicide.

The risk assessment specifically considered the effects of repeated and long-term exposure, which address the potential impact of cumulative effects, and concluded that there was no indication that a threshold for toxicity would be exceeded or for cumulative adverse effects to result (SERA 2004a).

Clopyralid

There are no data in the literature suggesting that clopyralid will interact, either synergistically or antagonistically with other compounds.

The risk assessment specifically considered the effects of repeated and long-term exposure. Long term exposure scenarios were substantially below the level of concern or were not plausible and should not be associated with cumulative adverse effects (SERA 2004b).

Dicamba

There is no substantial evidence that dicamba will interact with other compounds.

The risk assessment specifically considered the effects of repeated and long-term exposure. Long term exposure scenarios were below the level of concern and should not be associated with cumulative adverse effects (SERA 2004c).

Glyphosate

The most important connected action in the use of glyphosate is the use of surfactants. The use of formulas that contain POAE are not considered in this analysis.

It is possible that people could be exposed to multiple sources of glyphosate; however, the exposure scenarios indicate that multiple exposures do not exceed the level of concern. Currently the EPA does not have data at this time to determine whether glyphosate has a common mechanism of toxicity with other substances or how to include it in a cumulative risk assessment (SERA 2011a).

Imazamox

Imazamox formulations contain inert components and the metabolism involves the formation of other compounds. Based on the low hazard quotients derived from the exposure scenarios, there is not a plausible basis for suggesting that inerts, impurities, or metabolites will impact the risk characterization for effects.

Because imazamox and metabolic degradates have low toxicity, there is no concern regarding the potential for cumulative adverse effects with other substances with a common mode of action (SERA 2010).

Imazapic

The manufacturer recommends tank mixes with glyphosate and 2,4-D. No data are available for the combined toxicity with glyphosate and while the combination with 2,4-D is more toxic than with imazapic alone, that is likely due to the properties of 2,4-D.

The risk assessment specifically considered the effects of repeated and long-term exposure. Long term exposure scenarios were below the level of concern and should not be associated with cumulative adverse effects (SERA 2004d).

Imazapyr

Imazapyr formulations contain inert components and the metabolism involves the formation of other compounds. Based on the low hazard quotients derived from the exposure scenarios, there is not a plausible basis for suggesting that inerts, impurities, or metabolites will impact the risk characterization for effects.

Even though imazapyr is structurally similar to other imidazolinone herbicides (imazamox and imazapic), data do not support the conclusion that they share a common mechanism of toxicity and that the combined effect would result in cumulative effects. Because imazapyr has low toxicity, there is no basis for enhanced concern for the potential for cumulative adverse effects (SERA 2011b).

Metsulfuron methyl

There are no data in the literature suggesting that metsulfuron methyl will interact, either synergistically or antagonistically with other herbicides.

The risk assessment specifically considered the effects of repeated and long-term exposure, which address the potential impact of cumulative effects, and concluded that there was no indication that a threshold for toxicity would be exceeded or for cumulative adverse effects to result (SERA 2004e).

Picloram

The technical grade formulation of picloram contains hexachlorobenzene, which exposure scenarios determined that the potential carcinogenic risk was below the level of concern. The use of technical grade picloram is not considered in this analysis.

Picloram does not appear to produce a toxic metabolite produced by other substances. For the purposes of the analysis, picloram is assumed to not have a common mechanism of toxicity with other substances. The risk assessment specifically considered the effects of repeated and long-term exposure and should not be associated with cumulative adverse effects (SERA 2011c).

Sulfometuron methyl

There are no data in the literature suggesting that sulfometuron methyl will interact, either synergistically or antagonistically with other herbicides.

The risk assessment specifically considered the effects of repeated and long-term exposure, which address the potential impact of cumulative effects, and concluded that there was no indication that a threshold for toxicity would be exceeded or for cumulative adverse effects to result (SERA 2004f).

Triclopyr

Triclopyr is a relatively typical weak-acid auxin herbicide. Aminopyralid, clopyralid, and picloram are similar in structure; the way the chemical is absorbed, distributed, metabolized, and eliminated; and toxicity; therefore, there is a reasonable anticipation that exposure to triclopyr and these other weak-acid herbicides may result in additive risks (SERA 2011d).

The exposure scenarios in the risk assessment specifically addressed and encompassed the potential impact of the cumulative effects of repeated exposures to triclopyr for small and large mammal consuming contaminated vegetation over the long term (SERA 2011d).

Summary

The total land mass of the three counties is 7,521,388 acres. The total known annual average acres of applied herbicide for Butte, Custer, and Lemhi Counties which is applied by CWMA partners is less

than 5,000 acres, or 0.07% of the area. Private land makes up 8% of the counties. Even without knowing how much herbicide is applied to private land, the proportion of private land in relation to the three county-wide area is low. The applications of these herbicides are also spatially distinct. The herbicide applications identified in the alternatives would not be in the same locations as the applications identified in Table 3-8 and Table 3-9. None of the herbicides analyzed have an obvious cumulative adverse effects when used in combination with other herbicides. Given the relatively small proportion of treatment across the landscape, the implementation of design criteria designed and utilized to protect sensitive species, and the use of label guidelines for proper application, cumulative adverse effects to terrestrial wildlife species are not expected from the implementation of any of the action alternatives. All the proposed treatments used in conjunction with treatment methods that neighboring land management agencies, landowners, and CWMA partners implement may serve to increase the efficacy of treatments which could result in beneficial cumulative impacts to wildlife habitat.

3.6 Sensitive Plant Species

3.6.1. Introduction

The purpose of this section is to analyze and display the effects of proposed invasive plant management activities on Forest Service Intermountain Region (Region 4) sensitive plant species and candidate species the USFWS has concluded should be proposed for listing as endangered or threatened.

3.6.2. Measurement Indicators

Sensitive plant measurement indicators used in this analysis include:

- Effects of invasive plant treatment type on SCNF sensitive plant species
    - Biological control
    - Herbicide application
    - Mechanical control

3.6.3. Compliance with Forest Plan and Other Relevant Direction

The U.S. Fish and Wildlife Service (USFWS) oversees candidate species proposed for listing under the Endangered Species Act (ESA). These are species for which there is sufficient information regarding threats to populations and habitat to warrant listing as an endangered or threatened species under the ESA, but which are precluded from listing due to higher listing priorities (USFWS 2013). One of the SCNF sensitive plant species, whitebark pine, is also a candidate species for federal listing.

The FS defines sensitive species as those plant and animal species identified by a Regional Forester for which population viability is a concern, as evidenced by:

- significant current or predicted downward trends in population numbers or density,
- significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution (FSM 2670.5, 19).

In compliance with national law and policy to conserve sensitive plant species, Forest Service Manual direction (FSM 2670) instructs the FS to:

- maintain viable populations of native and desired non-native plant species in habitats distributed throughout their geographic range and,
- develop and implement management practices to ensure that species do not become threatened or endangered because of Forest Service actions.

Regarding native plant communities, the Salmon National Forest LRMP (USDA Forest Service 1988c) has a goal of providing representations of the various ecological stages of endemic plant communities. The Challis National Forest LRMP (USDA Forest Service 1987) states "sensitive plant species will be maintained".

To promote the achievement of national goals for the management of sensitive plants, the SCNF LRMP's goals and objectives include:

- controlling noxious weeds as needed to protect and enhance the value of other resources and to comply with Idaho state law.
- maintaining representation of the various ecological stages of endemic plant communities.
- managing habitat for threatened and endangered species and Forest Service sensitive species to maintain or improve the current condition of the habitat.

3.6.4. Methodology for Analysis

The techniques and methodologies used in this analysis consider pertinent available science. The analysis includes a summary of credible scientific evidence which is relevant to evaluating reasonably foreseeable impacts. The analysis also identifies methods used and references the scientific sources relied on. The conclusions are based on a scientific analysis that shows a thorough review of relevant scientific information.

The relevant science considered for this analysis consists of these elements:

Scientific literature: Relevant literature was used for understanding of potential effects.

Methods: The methods used to develop data for quantitative analysis was accomplished using software developed by Environmental Systems Research Institute (ESRI). Three types of operations were used- attribute queries, spatial queries and generation of new datasets from the original Forest Service GIS corporate data. The degree of spatial analysis range from simple queries about the spatial events to more complicated combinations of attribute queries, spatial queries and alterations of corporate data to create new layers for the purpose of this analysis.

Experience: The collective knowledge of the project by ID Team members through integration of science with local conditions.

The potential effects of invasive plant control methods are predictable and well documented. On the basis of the foregoing, it is our determination that we have considered science relevant to the effects of this project on vegetation of the SCNF within the project area.

Analysis Area

The project area forms the area of analysis for the SCNF sensitive plants for all alternatives. The area of analysis for cumulative effects to the sensitive plant species includes all of Butte, Custer, Lemhi and that portion of the Frank Church-River of No Return Wilderness managed by the SCNF.

3.6.5. Affected Environment

There are no ESA-listed threatened or endangered plant species in the SCNF. There is one candidate species, whitebark pine, proposed for listing under the Endangered Species Act. There are twenty-one sensitive plant species identified by the Regional Forester for the SCNF. Some of these species have highly specific habitat requirements and only occur in a few places. Other species have broad distributions and occur in a variety of cover types.

Table 3-50: Region 4 Sensitive Plant Species Occurrence by Invasive plant Management Zone displays the known presence of the candidate and sensitive plant species in the project area by invasive plant management zone, based on data queries of the USDA Forest Service NRIS database (2012). Of the five invasive plant management zones, the Pahsimeroi-Lost zone hosts the highest number of sensitive plant species, with known populations of six species. The Lemhi, Salmon, and Upper Salmon zones each contain known populations of five SCNF sensitive plant species. The North zone contains known populations of three SCNF sensitive plant species.

Table 3-50: Region 4 Sensitive Plant Species Occurrence by Invasive plant Management Zone

Scientific Name	Common Name	Habitat Association	Upper Salmon Zone	Pahsimeroi Lost Zone	Salmon Zone	North Zone	Lemhi Zone
Agoseris lackschewitzii	Pink agoseris	Wet meadows with soil saturated through the growing season.	Not Known to Occur	Not Known to Occur	X	Not Known to Occur	X
Astragalus amnis-amissi	Lost River milkvetch	Cracks in ledges of similar sites on near vertical limestone cliffs, and in talus at base of cliffs; mostly in moist shaded areas.	Not Known to Occur	X	Not Known to Occur	Not Known to Occur	Not Known to Occur
Astragalus aquilonius	Lemhi milkvetch	Unstable substrates such as gullies, washes and gravel banks often on southerly aspects.	Not Known to Occur	Not Known to Occur	Not Known to Occur	Not Known to Occur	Not Known to Occur
Astragalus diversifolius	Meadow milkvetch	Moist, alkaline soil in meadows and sagebrush valleys near springs and spring-fed streams.	Not Known to Occur	Not Known to Occur	Not Known to Occur	Not Known to Occur	Not Known to Occur
Astragalus vexilliflexus var. nubilus	White Cloud milkvetch	Dry open ridges in White Cloud Range	X	Not Known to Occur	Not Known to Occur	Not Known to Occur	Not Known to Occur

Scientific Name	Common Name	Habitat Association	Upper Salmon Zone	Pahsimeroi Lost Zone	Salmon Zone	North Zone	Lemhi Zone
Carex incurviformis var. incurviformis	Seaside sedge	Alpine and subalpine moist tundra and wet rock ledges. Elevation 10,000 to 12,200 ft.	Not Known to Occur	X	Not Known to Occur	Not Known to Occur	Not Known to Occur
Collomia debilis var. camporum	Flexible alpine collomia	Talus slopes at high elevations	Not Known to Occur	Not Known to Occur	X	X	Not Known to Occur
Cymopterus douglassii	Douglas' biscuitroot	Alpine and subalpine areas on open slopes, ridges, and summits in calcareous or dolomitic substrates	Not Known to Occur	X	Not Known to Occur	Not Known to Occur	X
Draba densifolia apiculata	Rockcress draba	Moist, gravelly alpine meadows and talus slopes, often on limestone-derived soils.	Not Known to Occur	Not Known to Occur	Not Known to Occur	Not Known to Occur	Not Known to Occur
Draba trichocarpa	Stanley's whitlow-grass	Steep slopes on granitic parent material	Not Known to Occur	Not Known to Occur	Not Known to Occur	Not Known to Occur	Not Known to Occur
Eriogonum capistratum var. welshii	Welsh buckwheat	Rocky volcanic slopes, gravelly clay or sedimentary barren flats with minimal vegetation consisting of scattered sagebrush and grasses	Not Known to Occur	X	Not Known to Occur	Not Known to Occur	Not Known to Occur
Eriogonum meledonum	Guardian buckwheat	Unstable scree slopes on granitic parent materials	Not Known to Occur	Not Known to Occur	Not Known to Occur	Not Known to Occur	Not Known to Occur
Lewisia sacajaweana	Sacajawea's bitterroot	Open ridgelines in montane and subalpine areas at high elevation on coarse-textured granitic and volcanic soils	Not Known to Occur	Not Known to Occur	Not Known to Occur	Not Known to Occur	Not Known to Occur
Oxytropis besseyi var. salmonensis	Challis crazyweed	Sagebrush and salt desert shrub in sandy washes or open slopes of rocky volcanic soil.	X	Not Known to Occur	Not Known to Occur	Not Known to Occur	Not Known to Occur

Scientific Name	Common Name	Habitat Association	Upper Salmon Zone	Pahsimeroi Lost Zone	Salmon Zone	North Zone	Lemhi Zone
Penstemon lemhiensis	Lemhi penstemon	Grassland and open ponderosa pine forests between elevation 6,300 and 7,200 ft.	Not Known to Occur	Not Known to Occur	X	X	X
Pinus albicaulis	Whitebark Pine	Harsh, high elevation sites across the northern Rocky Mountains, often on decomposed granitic soils. High and rapid mortality rate due to introduced blister rust	X	X	X	X	X
Physaria didymocarpa var. lyrata	Salmon twin bladderpod	Rocky, sparsely vegetated, south slopes. Bare ground and rock coverage (1-3 inches rock)	Not Known to Occur	Not Known to Occur	X	Not Known to Occur	X
Poa abbreviata ssp. Marshii	Marsh's bluegrass	Alpine fell-fields	Not Known to Occur	X	Not Known to Occur	Not Known to Occur	Not Known to Occur
Thelypodium repandum	Wavy-leaf thelypody	Moderate to steep, unstable, generally southerly facing slopes of rocky, gravelly to cindery substrate derived from Challis volcanic and metamorphic rock. Associated vegetation is sparse (5 to 20% cover), and bare ground coverage is high	X	Not Known to Occur	Not Known to Occur	Not Known to Occur	Not Known to Occur
Thlaspi idahoense var. aileeniae	Stanley thlaspi	Steep slopes on sandy and gravelly soil on sagebrush flats	X	Not Known to Occur	Not Known to Occur	Not Known to Occur	Not Known to Occur
Xanthoparmelia idahoensis	Idaho range lichen	Calcareous badlands on gentle to moderate slopes that are barren to sparsely vegetated with shrub-steppe plants	Not Known to Occur	Not Known to Occur	Not Known to Occur	Not Known to Occur	Not Known to Occur

USDA Forest Service SCNF NRIS database 2012

Fourteen SCNF sensitive plant species are known to occur in the project area (Table 3-50). Seven of the SCNF sensitive plant species displayed in Table 3-50 are not known to occur in the project area as no populations have been found in the project area. These species are guardian buckwheat, Idaho range lichen, Lemhi milkvetch, meadow milkvetch, rockcress draba, Sacajawea's biscuitroot, and Stanley's whitlow-grass. Of these seven species, it is highly likely that four do not occur in the project area based on (1) highly specific habitat requirements or (2) the fact that searches in apparently suitable habitat have failed to detect the species. These include Lemhi milkvetch, Stanley's whitlow-grass, guardian buckwheat, and Idaho range lichen. Based on thorough searches by Moseley (1988), the project area does not contain habitats with the specific soil substrates required by Lemhi milkvetch. Stanley's whitlow-grass and guardian buckwheat are highly localized species that are endemic only to the Stanley Basin in a small area around Stanley and Lower Stanley, Idaho (Moseley 1988). Idaho range lichen has specific habitat requirements that are not met on Forest Service lands in the project area (A. Cochrane, personal communication, 2014), although it occurs at lower elevations in the Lemhi River valley (NatureServe 2013).

Based on habitat requirements and known range and distribution, the other three species not known to occur within the project area (meadow milkvetch, rockcress draba, and Sacajawea's bitterroot) could potentially be present, but have been undetected to date. Apparently suitable habitat for meadow milkvetch occurs in proximity to invasive plant infestations or to roads and trails where invasive plants could potentially be introduced. Meadow milkvetch populations, if present, could potentially be affected by invasive plant invasion or invasive plant control activities.

Seven species are not currently associated with any known invasive plants populations (USDA Forest Service NRIS database 2012) or invasive plant control activities, including Lost River milkvetch, Whitecloud milkvetch, rockcress draba, seaside sedge, Douglas' biscuitroot, Sacajawea's bitterroot and Marsh's bluegrass. These species occur in very specific habitats, such as cliffs or talus or at high to very high elevations above treeline. These habitats are often away from roads or trails and experience less human activity than more accessible areas. This provides a greater degree of protection from the effects of invasion and invasive plant control activities.

Only one sensitive plant species, whitebark pine, occurs in all five zones. The next species with the broadest distribution is Lemhi penstemon, which occurs in the North, Lemhi, and Salmon zones (USDA Forest Service NRIS database 2012). Four SCNF sensitive plant species occur in only two of the five zones while eight species are known to occur only in one zone (Table 3-50).

The listing status, biological requirements, trend, and potential occurrence of all the species listed in this section are available in the project area in the Salmon-Challis NF Invasive Plant Treatment Sensitive Plant Specialist Report.

Table 3-51: SCNF Sensitive Plant Species Analysis Rationale

Scientific Name	Common Name	Rationale for Analysis
Agoseris lackschewitzii	Pink agoseris	Some populations in areas with roads or close to roads, some populations with or in close proximity to invasive plant infestations, habitat moderately susceptible to invasive plant invasion.[1,2]
Astragalus amnis-amissi	Lost River milkvetch	No roads or invasive plant infestations in proximity to populations, habitat not very susceptible to invasion. [1,2]
Astragalus aquilonius	Lemhi milkvetch	Not present. [1] No detections resulted from thorough searches of apparently suitable habitat.
Astragalus diversifolius	Meadow milkvetch	Not known to be present, apparently suitable habitat suggests it could occur; habitat in proximity to roads, trails and invasive plant infestations, moderately susceptible to invasion. [1,2]
Astragalus vexilliflexus var. nubilus	Whitecloud milkvetch	No roads or invasive plant infestations in proximity to population, habitat not very susceptible to invasion. [1,2]
Carex incurviformis var. incurviformis	Seaside Sedge	No roads or invasive plant infestations in proximity to only known population, occurs at very high elevation in habitat not very susceptible to invasion. [1,2]
Collomia debilis var. camporum	Flexible alpine collomia	Some populations in areas with roads or close to roads, some populations with or in close proximity to invasive plant infestations, habitat not very susceptible to invasion. [1,2]
Cymopterus douglassii	Douglas' biscuitroot	No roads or invasive plant infestations in proximity to populations, which occur at very high elevation in habitat not very susceptible to invasion. [1,2]
Draba densifolia apiculata	Rockcress draba	Not known to be present, apparently suitable habitat suggests it could occur, populations would occur at very high elevation in isolated habitat not very susceptible to invasion. [1,2]
Draba trichocarpa	Stanley's whitlow-grass	Not present. [1] No detections resulted from thorough searches of apparently suitable habitat.
Eriogonum capistratum var. welshii	Welsh buckwheat	Populations located near roads, infested by multiple invasive plant species, habitat susceptible to invasion. [1,2]
Eriogonum meledonum	Guardian buckwheat	Not present. [1] No detections resulted from thorough searches of apparently suitable habitat.
Lewisia sacajaweana	Sacajawea's bitterroot	Not known to be present, apparently suitable habitat suggests it could occur, populations would occur at very high elevation in isolated habitat not very susceptible to invasion. [1,2]
Oxytropis besseyi var. salmonensis	Challis crazyweed	Some populations near roads, although not currently threatened by invasive plants, habitat susceptible to invasion.
Penstemon lemhiensis	Lemhi penstemon	Some populations in areas with roads or close to roads, some populations with or in close proximity to invasive plant infestations, habitat susceptible to invasion. [1,2]
Physaria didymocarpa var. lyrata	Salmon twin bladderpod	Some populations in areas with roads or close to roads, some populations with or in close proximity to invasive plant infestations, habitat susceptible to invasion. [1,2]

Scientific Name	Common Name	Rationale for Analysis
Pinus albicaulis	Whitebark pine	Some populations near roads, although not currently threatened by invasive plants, habitat not very susceptible to invasion. [1,2]
Poa abbreviata ssp. Marshii	Marsh's bluegrass	No roads or invasive plant infestations in proximity to population which occurs at very high elevation in habitat not very susceptible to invasion. [1,2]
Thelypodium repandum	Wavy-leaf thelypody	Some populations near roads, although not currently threatened by invasive plants, habitat susceptible to invasion. [1,2]
Thlaspi idahoense var. aileeniae	Stanley thlaspi	Some populations near roads, although not currently threatened by invasive plants, habitat susceptible to invasion. [1,2]
Xanthoparmelia idahoensis	Idaho range lichen	Not known to be present.[1] Specific habitat requirements indicate that it is very unlikely to occur.

[1]USDA Forest Service NRIS database 2012
[2]Prather 2007

3.6.6 Environmental Consequences

3.6.5.1. Alternative 1-No Action

The impacts of non-native invasive plant species have assumed crisis proportions throughout much of the United States, including national forest system lands (Westbrooks 1998, USDA Forest Service 2004). The number of invasive plant species and area occupied continue to increase as a result of human uses and movement patterns. Invasive plants arrive in this country without the array of insect and disease organisms that control their density and distribution in their native countries (LeJeune and Seastedt 2002). As a result, some species become unusually aggressive in their new environment; they are able to establish monocultures and crowd out native plants. Another reason non-native plant species can become invasive in new environments is that they are often highly competitive in acquiring resources, such as water, soil nutrients or light (Whitney and Gabler 2008). They may have long seed longevity, germinate and establish root systems quickly, produce large amounts of seed, or have longer periods of active growth that enable them to gain an advantage over less competitive plant species that do not share these traits.

At a landscape level, the process of invasion by non-native plant species translates into a cascading set of changes in complex ecological interactions and ecosystem processes. These changes include loss of native plant diversity, loss of soil stability, increased erosion, and increased and more frequent natural disturbance cycles (Westbrooks 1998, Sheley and Petroff 1999, Harrod 2001, Chornesky et al. 2005).

Direct and Indirect Effects

Under the No Action alternative, invasive plants would infest susceptible plant communities across the SCNF without intervention. Existing infestations would eventually expand to the limits of suitable habitat with the abandonment of current containment boundaries. These existing infestations would act as reservoirs to infest new areas. This would include even steep, inaccessible or remote areas as invasive plants would be moved by birds, animals, wind and water. There would

be an increase in the number of spot infestations arising from these existing infestations, contributing to an increased rate of growth. The density of existing infestations would also increase.

Invasive plants would move along vector routes, such as roads and trails, as spread by human activities and animal movements. Infestations would establish and spread rapidly along the length of roads and trails with the cessation of invasive plant control activities (Ferguson et al. 2003, Taylor et al. 2012). Road and trail corridors would become heavily infested with invasive plants. Vehicles, people and animals would pick up invasive plant seeds traveling along infested roads and trails and could then introduce seeds into areas that are currently uninfested.

Without control, invaders would have a high potential for exponential growth. The rate at which invasive plant infestations expand can sometimes be difficult to determine since spread rates vary depending on the invasive plant species, size of current infestation, disturbance history, present disturbances and site productivity at each site. Moreover, invasive plant expansion may be exponential (i.e. a constant proportional rate of increase) or two-phased (a sudden range expansion following a period of little or slow increase in distribution). However, once established, invasive plant populations typically increase rapidly. Duncan and Clark (2005) found rates of spread ranging from 8% to more than 30% annually. Table 3-45 displays the increase in acreage over a ten-year span at average annual rates of spread (Duncan and Clark 2005) for several non-native invasive plant species found in the SCNF. This illustrates how invasive plants, once introduced, can spread quickly without intervention.

Invasive plant invasion and spread can impact native plant populations in a myriad of ways, of which many are intricate and interconnected relationships. These can include direct competition for resources such as growing space, nutrients, pollinators, sunlight and water (Sheley and Petroff 1999, Bjerknes et al. 2007). Native plant richness and abundance may decline as invasive plant density increases (Ortega and Pearson 2005). Perennial native plant species may be more affected than annual species (Ortega and Pearson 2005). Lesica and Shelly (1996) found that spotted knapweed invasion affected population dynamics in a study of the rare native plant *Arabis fecunda*. Spotted knapweed affected population growth by inhibiting recruitment. Indirectly, invasive plant invasion impacts the biotic and abiotic components of native plant communities, both above ground and underground (Klironomos 2002, Erhenfeld 2003, Callaway et al. 2004, Yurkonis et al. 2005). For example, these can include alterations to soil and soil microflora and microfauna assemblages, increases in soil erosion, and a reduction in water-holding capacity.

Nutrient levels and nutrient cycling may be affected. There may be distinctive shifts in plant community structure and function (Chambers et al. 2013). Some of these shifts can be unexpected and can have long-term repercussions. For example, pollinator populations and the population of species that prey on pollinators (e.g. spiders) may be affected as invasive plant invasion changes the structural composition of the plant community (Pearson 2009). Other plant reproductive mechanisms, such as seed dispersal, may also be impacted (Traveset and Richardson 2006). Native plants become stressed from the additional ecological burden imposed by invasive plants. The percentage of native vegetation occupying a site may decline as invasive plant density increases. Eventually, there can be a loss of native plant diversity as native species decline, or in some cases, are eliminated from the community. Native plants that become stressed by invasive plant invasion become more vulnerable to other stressors, such as drought or fire. Some species may be unable to effectively recover on a site impacted by invasive plant invasion and other site disturbances. In extreme cases, native plants may be relegated to “refugia”; that is, marginal habitats unsuitable to

invasive plant invasion (Gilbert and Levine 2012). These refugia may be patchy and disconnected, leading to a breakdown of native plant community metapopulation structure.

Native plant species that are designated as sensitive are often already precariously situated. Sensitive plant species may be threatened by loss of habitat or may be experiencing downward trends in habitat quality and population status across all or part of their range, such as whitebark pine

Even sensitive plant species that are not in decline due to habitat or population factors may still naturally have limited distribution and population numbers. For example, some sensitive plant species may grow only in very specific habitat conditions, such as Lost River milkvetch. They may simply be an uncommon plant species that is a minor component of the plant communities in which they are found, such as pink agoseris. Other sensitive plant species, such as Lemhi penstemon, might be relatively common and widespread throughout their range, but experience a number of threats to habitat (Elzinga 1997, Heidel and Shelly 2001, Stucki et al. 2013).

Cumulative Effects

In the absence of invasive plant management, existing infestations would persist, new infestations would establish and new invaders would continue to arrive. New invaders could become common and widespread without early detection and rapid response management actions. Eventually, given enough time, existing and new invasive plants could potentially colonize and occupy all suitable habitats. The No Action alternative would contribute to cumulative increases in invasive plants in terms of number, size and density of infestations.

The No Action alternative would place an additional burden on other invasive plant management entities as well. Were the FS to discontinue invasive plant control on SCNF lands, new invasive plants and new infestations would increase the potential for invasive plants to be vectored via animals or humans to lands under other jurisdictions. Human activities and uses of SCNF lands are displayed in Appendix H. In general, these activities have the potential to cumulatively affect sensitive plant species.

Most human activities and uses affect native plant communities through soil and vegetation disturbance. Effects can range from mild to severe. Impacts to vegetation can include outright removal of native vegetation for construction of facilities or travel routes, invasive plant introduction and spread, changes in cover type and structural stage or changes in plant community composition and structure. Effects to soil resources can include soil disturbance, compaction, erosion, changes in water holding capacity, or changes in soil structure. Extreme impacts can involve major erosion events, such as gullying, mass wasting, slumping or landslides. It is apparent that detrimental changes resulting from human activities and uses to native plant communities or to soil resources in occupied habitat have the potential to impact SCNF sensitive plant populations. These can be one-time events or small, incremental changes that cumulatively lead to decreases in habitat quality, habitat fragmentation or, in some cases such as mine development, habitat loss. Humans are the ultimate source of the global introduction and spread of invasive plants. Human activities and land uses on SCNF are typical of those that introduce invasive plants and create conditions that lead to invasive plant invasion and spread.

The daily and seasonal movements of the large number of wildlife species occupying the SCNF would obviously continue regardless of the decision the forest makes regarding invasive plant

management. However, wildlife movements can play a substantial role in the introduction and distribution of non-native invasive plants. For example, mourning doves are known to spread hoary alyssum and leafy spurge seeds to uninfested areas and thus, contribute to the spread of these invasive plant species. Large mammals, such as deer, elk, and black bears, are known to move houndstongue seeds broadly across the landscape and are primarily responsible for the spread of this species into remote areas or sites largely inaccessible to humans. Along with the natural movements of wildlife, the lack of invasive plant management under the No Action alternative would cumulatively contribute to the continued establishment and spread of invasive plants on SCNF. Since seasonal animal movements often cover very large areas, the cumulative effects of unchecked spread of invasive plants combined with animal movements could vector invasive plants into habitats occupied by SCNF sensitive plant species.

Natural events (e.g. flooding, fire, storms, and drought) would continue to create disturbed areas susceptible to invasion. In conjunction with the cessation of invasive plant control, these natural events could have cumulative negative impacts to SCNF sensitive plant species. For example, invasive plant species could spread more rapidly in burned areas because post-fire conditions often favor many of the invasive plant species, such as spotted knapweed, that occur in the SCNF. This could impact Lemhi penstemon, in particular, since it occurs in low to mid-elevation grass, sage/grass and xeric conifer forest communities. While early seral plant species, such as Lemhi penstemon, often respond positively to disturbance events, the added burden of invasion and the associated changes in the abiotic and biotic components of a given habitat can overwhelm the capacity of a sensitive plant species to recover (Elzinga 1997, Heidel and Shelly 2001, Stucki et al. 2013). For example, invasion can affect soils by reducing water holding capacity and litter cover and increase the amount of interstitial space. This can result in increased erosion and loss of water holding capacity. Late seral plant species that depend on stable habitat conditions can be greatly affected by disturbance events. Any declines in habitat capability and productivity have the potential to negatively affect sensitive plant species.

Moreover, the cumulative effect of unmanaged invasive plant infestations combined with the disturbance potential of natural events could result in an increase of the annual rate of invasive plant spread. As depicted in Table 3-45 unmanaged invasive plants have the capacity for rapid increases in density and distribution. Unchecked invasive plant spread could result in the movement of invasive plants into currently uninfested habitat that is occupied by SCNF sensitive plant species. This places a greater ecological burden on a rare plant species and the habitat which sustains it.

No Action Summary

The No Action alternative does not comply with legal requirements or with FS national and regional direction on the management of non-native invasive plants species. Neither does it contribute to attainment of the desired condition for native plant communities, including SCNF sensitive plant species, in the project area. In conclusion, ending all invasive plant management practices in the SCNF could result in an unchecked expansion of invasive plants into habitats occupied by SCNF sensitive plant species. If, at a later time, the SCNF chose to re-establish invasive plant management, many more acres of habitat would have been infested and new invasive plant species would likely have established, making invasive plant control that much more difficult and expensive. In areas occupied by SCNF sensitive plant species, this would result in greater impacts due both to the ecological burden placed on sensitive plants by invasion and the effects of invasive plant control

actions on sensitive plant populations. Table 3-52 displays the determination of effects to habitat and sensitive plant populations by species as a result of implementing the No Action alternative.

Table 3-52: Determination of Effects to Sensitive Plant Habitat and Plants Resulting from Alternative 1

Sensitive Plant Species	Effects to Habitat	Effects to Plants	Effects Determination
Pink agoseris	Short-term and long-term adverse impacts	Short-term and long-term adverse impacts to populations	May impact, likely to result in a trend to federal listing or loss of viability (MIIH)
Lost River milkvetch	Long-term adverse impacts	Long-term adverse impacts to populations	MIIH
Lemhi milkvetch	None	None	No Impacts
Meadow milkvetch	Short-term and long-term adverse impacts	Short-term and long-term adverse impacts to populations	MIIH
Whitecloud milkvetch	Short-term and long-term adverse impacts	Short-term and long-term adverse impacts to populations	MIIH
Seaside sedge	Short-term and long-term adverse impacts	Short-term and long-term adverse impacts to populations	MIIH
Flexible alpine collomia	Short-term and long-term adverse impacts	Short-term and long-term adverse impacts to populations	MIIH
Douglas' biscuitroot	Short-term and long-term adverse impacts	Short-term and long-term adverse impacts to populations	MIIH
Rockcress draba	Short-term and long-term adverse impacts	Short-term and long-term adverse impacts to populations	MIIH
Stanley's whitlow-grass	None	None	No Impacts
Welsh buckwheat	Short-term and long-term adverse impacts	Short-term and long-term adverse impacts to populations	MIIH
Guardian buckwheat	None	None	No Impacts
Sacajawea's biscuitroot	Short-term and long-term adverse impacts	Short-term and long-term adverse impacts to populations	MIIH
Challis crazyweed	Short-term and long-term adverse impacts	Short-term and long-term adverse impacts to populations	MIIH
Lemhi penstemon	Short-term and long-term adverse impacts	Short-term and long-term adverse impacts to populations	MIIH
Salmon twin bladderpod	Short-term and long-term adverse impacts	Short-term and long-term adverse impacts to populations	MIIH

Sensitive Plant Species	Effects to Habitat	Effects to Plants	Effects Determination
Whitebark pine	Long-term adverse impacts	Unknown	May impact individuals, but is not likely to cause a trend to federal listing or loss of viability
Marsh's bluegrass	Short-term and long-term adverse impacts	Short-term and long-term adverse impacts to populations	MIIH
Wavy-leaf thelypody	Short-term and long-term adverse impacts	Short-term and long-term adverse impacts to populations	MIIH
Stanley thlaspi	Short-term and long-term adverse impacts	Short-term and long-term adverse impacts to populations	MIIH
Idaho range lichen	None	None	No Impacts

3.6.5.2. Information Common to All Action Alternatives

Invasive plant control activities can affect non-target, native plant species, including SCNF sensitive plant species, so a set of design criteria was developed to provide guidance when planning invasive plant control around sensitive plant populations (Appendix J). These are intended to minimize impacts to sensitive plants from invasive plant control activities while working toward the desired condition for sensitive plant populations and habitats.

Protecting sensitive plants during invasive plant control activities is very attainable. Design criteria include practices such as using mechanical control methods where practicable, using herbicides with very short residual activity, making herbicide applications when sensitive plants are dormant, or applying herbicides using highly target specific methods such as spot spraying and making sponge, wand or wiper applications using specialized equipment.

Monitoring and Treatment Effectiveness

A variety of monitoring practices are routinely implemented. These include design criteria implementation monitoring, effectiveness monitoring, field observations, photo points, and reports that summarize annual invasive plant management activities. These various types of monitoring help assess progress with invasive plant management and comply with FS protocols.

Monitoring informs managers of the effectiveness of invasive plant control measures, impacts to non-target vegetation, and detects the trend, up or down, of vegetation and soil resources. This includes SCNF sensitive plant populations. Monitoring in sensitive plant populations helps invasive plant program managers determine the efficacy of the invasive plant control treatments, response of non-target vegetation, including sensitive plants and the habitat condition. Managers use the monitoring to make adjustments to IWM as needed to achieve the desired condition for the site.

3.6.5.3. Alternative 2-Current Action

Direct and Indirect Effects

Biological Control

Classical biological control is the introduction of host-specific plant pests and pathogens from their native ranges into new areas across the world where they can be used to control invasive plants (Harris 1991, Sheley and Petroff 1999). Within the project area, biological control agents have no direct effects to non-target plants. The U.S. Animal and Plant Health and Inspection Service (APHIS) regulates the approval process for biological control agents and extensive testing is required to be certain biological control agents demonstrate host species specificity prior to being approved for use. In the past, when standards were not as strict, some agents were found to shift to non-target plants that are closely related to the host plant species (Simberloff and Stiles 1996). However, there are no biological control agents in use in the SCNF known to attack non-target plants in plant families represented by sensitive plant species. There would be no direct effects to sensitive plant species resulting from the use of biological control agents.

The effect of biological control agents on native plant communities is usually expressed indirectly. If agents are successful in reducing seed production, impacting host plant vigor or slowing the rate of invasive plant spread, then desirable plant communities may be better able to withstand the impacts associated with invasive plant infestation and maintain a viable presence in the altered plant community. However, unless a biological control agent is very successful, this beneficial effect may be minor. The indirect benefits may also be short-lived or cyclical as populations of biological control agents naturally fluctuate based on environmental conditions and host plant populations.

Another potential scenario could occur in a sensitive plant population infested by multiple invasive plant species. There could be a reduction in density of one invasive plant due to an effective biological control agent, thereby resulting in an increase in density of other invasive plants occupying the site. In such a case, this would not result in a reduced need for mechanical or herbicide treatment.

Herbicide Control

Herbicide application is an important invasive plant control strategy and ten herbicides are currently used in the SCNF as part of the IWM program. Table 2-2 displays herbicides currently used in the SCNF by active ingredient, maximum and typical application rates, and general type of application.

Herbicide application utilized properly is an important tool in managing invasive plants. Selective management of invasive plants, that allows desired vegetation to recover from invasive plant infestation and re-establish strongly following herbicide treatment, can be accomplished by applying the appropriate herbicides at an appropriate rate and by using appropriate application techniques that minimize affects to desirable species. The use of design criteria and standard operating practices contribute to successful herbicide management by minimizing impacts to desirable plants.

The intention of an herbicide application is to eradicate or suppress infestations of invasive plants through direct mortality, decreased plant density, reduced competitiveness, and cessation of seed production or root system expansion (Bussan and Dyer 1999). The intended result is expressed in an

increase in desirable plant abundance and vigor, creating more invasive plant-resistant plant communities.

Herbicides are usually classified based on their chemical structure or mode of action and are taken up by plant roots or through foliage and transported within the plant through the vascular system. Herbicides kill or stress plants by inhibiting enzymes involved in photosynthesis, respiration, and other physiological processes (Bussan and Dyer 1999).

Although herbicides have the potential to affect both invasive plants and desirable plants, there are differences in susceptibility to herbicides among plant species and families (Rice and Toney 1996). Some plants (both invasive plants and desirable plants) metabolize herbicides, which reduces toxic effects. Some species do not readily absorb herbicides through foliage and roots. For herbicides to be effective, they must be taken into the plant and impair physiological processes (Bussan and Dyer 1999).

Plant species that have similar growth forms (e.g. leaf structure and root systems) and genetic composition often are similarly affected by herbicides; consequently, herbicides have the potential to adversely affect invasive plants and desirable plants that have similar growth forms, genetic makeup, and life history characteristics (Rice and Toney 1996). Appendix I displays non-target vegetation groups and their relative susceptibility to herbicide treatment. In general, most herbicides currently being used in the SCNF (with the exception of glyphosate) have a higher potential to affect broad-leaf plants than graminoids (grasses and sedges) (Rice and Toney 1998, Bussan and Dyer 1999).

The most common direct effect of herbicide to susceptible plants is mortality, since that is the function of an herbicide. Non-lethal effects include reduced plant growth, reduced biomass and vigor, and reduced reproductive success. Indirect adverse effects can be more difficult to observe and ascertain than the direct effects. For example, an impacted plant may have difficulties with photosynthesis and in acquiring and storing nutrients or water (Bussan and Dyer 1999). Its competitive ability may be reduced for a period of time. Detrimental indirect effects to non-target plants may involve a prolonged period of recovery to restore biomass and regain the root reserves needed to resume seed production or vegetative reproduction.

Non-target plants can also be affected by residual herbicide activity (Bussan and Dyer 1999). Herbicides that are short-lived and become detoxified in a few days or weeks, such as 2,4-D, have less potential to indirectly affect non-target plants through soil activity. Other herbicides, such as picloram, can remain active in the soil for more than one year. As an example, native plants that were dormant during a late summer herbicide application could be damaged by residual amounts of picloram the following spring when plant growth resumes. Non-lethal damage could include reduced biomass, vigor and reproductive success. However, studies from western Montana using picloram, clopyralid, and 2,4-D found no evidence of lingering damage from residual herbicide concentrations at the plant community level (Rice et al. 1992, Rice et al. 1997, Rice and Toney 1998).

A particular herbicide is chosen for use based on the target invasive plant species, presence of desirable non-target vegetation, proximity to water, and distribution of desirable species. Site factors, such as soil type, and season of use are also considerations. Clopyralid is an example of one of the most selective herbicides currently in use on SCNF while glyphosate is a nonselective herbicide that will kill most plant species, including graminoids. Clopyralid, for example, is often

selected for use in and around Lemhi penstemon populations because it is more selective and because Lemhi penstemon displays some tolerance to clopyralid (Rice 2012).

Most of the SCNF sensitive plant species are broad-leaf forbs and should be considered susceptible to herbicides. However, like other broad-leaved plants, the SCNF sensitive plants differ in their tolerance to herbicides overall and to specific herbicides. Three sensitive plant species, Salmon twin bladderpod, Stanley thlapsi, and wavy-leaf thelypody, are members of the mustard plant family. Mustards are resistant to a number of broad-leaf herbicides, such as clopyralid or picloram. Applying one of these herbicides to spotted knapweed, a member of the sunflower plant family, would be unlikely to result in direct herbicide impacts to any of these three sensitive plant species in the mustard family. On the other hand, pink agoseris, like spotted knapweed, is a member of the sunflower plant family and an application of clopyralid, for example, that targets broadleaf invasive plants in this plant family could also kill pink agoseris plants. In a situation such as this, timing of application and herbicide selection are important factors to reduce to the likelihood of adverse impacts.

Applications of a non-selective herbicide, such as glyphosate, made during active growth stages would kill or injure individual sensitive plant species. In regards to whitebark pine, only foliage that was sprayed would be affected. However, glyphosate does not have any soil residual activity and if applied at a time when invasive plants were actively growing, but sensitive plants were dormant, then the application would have no direct or indirect adverse impacts.

Populations of eight sensitive plant species are not currently associated with any invasive plant infestations (USDA Forest Service SCNF NRIS database 2012). These include Lost River milkvetch, Whitecloud milkvetch, seaside sedge, Douglas' biscuitroot, Challis crazyweed, Marsh's bluegrass, wavy-leaf thelypody, and Stanley thlapsi. For these sensitive plant species, at present only monitoring is required from time to time to ensure that the populations are still invasive plant-free and that invasive plants are not encroaching (from nearby roads, for example). As long as these populations are inspected and remain invasive plant-free, there would be no effects from herbicide. If, in the future, it was discovered that invasive plants were beginning to infest these populations, mechanical removal or highly targeted spot applications would be implemented to eradicate the invasive plants. Direct and indirect impacts to individual sensitive plants or to the populations at the very beginning of invasion would be very slight.

While there are no known populations of rockcress draba or Sacajawea's bitterroot in the SCNF, the presence of apparently suitable habitat suggests they could occur. Like seaside sedge or Marsh's bluegrass, populations of these two species would occur in isolated high to very elevation habitats. The isolated nature of these habitats away from roads, trails or other areas with human activity tends to provide protection from invasion (Prather 2007). Populations of these species, if present, are probably in an invasive plant-free condition currently.

There are some populations of other SCNF sensitive plant species that are threatened by invasive plants (USDA Forest Service SCNF NRIS database 2012). These include pink agoseris, flexible alpine collomia, Welsh's biscuitroot, Lemhi penstemon, and Salmon twin bladderpod (Table 3-51). Canada thistle infests a number of wetlands occupied by pink agoseris. Spotted knapweed is known to occur along Highway 93N near populations of flexible alpine collomia. Likewise, a number of populations of Salmon twin bladderpod are infested with spotted knapweed. Populations of Welsh's biscuitroot are infested by multiple invasive plant species, including Canada thistle, leafy

spurge, and musk thistle. Populations of Lemhi penstemon, which has a broad distribution in the northern portion of the project area and which can be locally abundant when growing conditions are suitable, are often found infested with spotted knapweed or, less often, hoary alyssum (USDA Forest Service SCNF NRIS database 2012).

One other SCNF sensitive plant species that is not known to be present in the project area, meadow milkvetch, could also potentially be affected. Although meadow milkvetch is undetected to date, the presence of apparently suitable habitat in the project area and the proximity of known populations to the project area suggest it could occur. Apparently suitable habitat is located within proximity to roads and trails and existing invasive plant infestations are present in some areas of potential habitat. The presence of roads, trails and existing infestations suggest meadow milkvetch could be impacted by invasive plants and herbicide applications.

Across the forest, whitebark pine habitat is little infested with invasive plants at present, although abundant roads and trails increase the susceptibility of the habitat to invasion (Prather 2007). Due to its growth form as a tree, mature whitebark pine would seldom be exposed directly to herbicide although seedlings and saplings could be exposed.

Herbicide applications to control invasive plants within populations of SCNF sensitive plant species would have the potential to adversely impact individual plants and small groups of plants, especially when plants are actively growing in the spring and early summer. Herbicide applications made in the late summer or fall, when plants are dormant, would have less potential for direct effects.

Spot spraying of invasive plants in and near sensitive plant populations would greatly reduce the risk of mortality to individual plants. Other standard operating practices that reduce the impacts of herbicide application to sensitive plant species include herbicide selection and the use of the lowest effective herbicide use rate.

In addition to herbicide selection and lowest effective application rates, technique is also an important decision. The two primary types of herbicide application used in the SCNF are spot treatment and broadcast application. In a broadcast application, herbicide is sprayed over the top of vegetation and is applied to both target and non-target vegetation. In the SCNF, broadcast application is not used in and directly adjacent to known sensitive plant populations. In contrast, spot treatment is performed by spraying individual invasive plants and the area directly around them, avoiding application to non-target plants. In the SCNF, only spot herbicide application is made in and directly adjacent to known sensitive plant populations. Spot application of herbicides greatly reduces the impacts to individual sensitive plants and therefore to sensitive plant populations as well.

Overall, the amount of herbicide applied annually throughout the project area is very low. With the exception of Lemhi penstemon, which is widespread throughout the northern portion of the project area (USDA Forest Service NRIS database 2012), and Welsh's buckwheat, populations of SCNF sensitive plant species present in the project area are seldom exposed to herbicide.

Some Lemhi penstemon populations in the North zone are exposed to herbicide regularly since spotted knapweed is widely distributed in the North zone (USDA Forest Service SCNF NRIS database 2012). Biological control agents are used to manage these spotted knapweed infestations wherever possible, but biological control alone is not sufficient to reduce spotted knapweed density or rate of spread. Spotted knapweed invasion into Lemhi penstemon habitat is recognized as a threat to the

species and herbicide is an important tool for spotted knapweed control (Elzinga 1997, Rice 2012, and Stucki et al 2013). Since Lemhi penstemon is widespread and its population status is secure in SCNF, mortality of individual plants or small groups is considered an acceptable trade-off for achieving reduced spotted knapweed cover and limiting its spread. As invasive plant management objectives are met, native plant species, including Lemhi penstemon, can re-establish in areas formerly occupied by spotted knapweed.

Some Welsh's buckwheat populations in the SCNF are infested with leafy spurge (USDA Forest Service NRIS database 2012). Leafy spurge is a particularly aggressive and difficult to control invasive plant. In the SCNF, these infestations are treated with herbicides regularly with the objective of maintaining low enough leafy spurge cover to allow native plants to remain on site (as opposed to a monoculture of leafy spurge). Incidental damage to individual Welsh's buckwheat plants has been necessary to achieve invasive plant management objectives. As leafy spurge cover has declined with treatment, native plants, including Welsh's buckwheat, are able to re-establish in areas formerly occupied by leafy spurge. SCNF managers also consider other aspects of herbicide application, such as volatilization, drift and movement of herbicide through soil or water. Herbicide can move with eroding or windblown soil or with surface or subsurface water. Herbicides can also move through the air as spray drift, which occurs during herbicide application, and volatilization, which could occur after application. Spray drift is dependent on spray equipment parameters such as nozzle orifice size, boom height and pressure, and wind speed (Branham and Hanson 1987). Volatility is dependent on the physical properties of the herbicide, primarily vapor pressure.

Volatilization is the conversion of a liquid or solid chemical to a gas. In the case of an herbicide that volatilizes, the vapor can then move with air currents away from the treatment site and affect non-target plants. The amount of volatilization that occurs is dependent upon climactic and microclimactic conditions. Soil moisture is the primary environmental condition that influences the rate at which herbicides volatilize; in general, herbicides volatilize more rapidly from moist soils than dry soils (Menalled and Dyer 2005). Volatilization also increases with higher air and soil temperatures and increasing wind speed. Ester formulations of herbicides have higher vapor pressures and volatilize more than amine formulations (Nice et al. 2004). No ester formulations are proposed for use by the SCNF. Table 3-10 displays volatilization potential of herbicides currently used in the SCNF. The potential for volatilization can be minimized in a number of ways, some of which are operational and some environmental. Using water as a carrier and the use of specific adjuvants further reduces the likelihood of volatilization. It is very unlikely that any SCNF sensitive plants would be affected by volatilization.

Spray drift is the movement of herbicide, generally via spray droplets, away from the target area. Spray drift is easily managed through standard operating practices. The primary way in which spray drift can be reduced is by increasing droplet size. This can be done by reducing spray pressure, increasing nozzle orifice size, using drift reduction nozzles, and the addition of adjuvants to the mixture. Design criteria (Appendix I), such as maximum allowable wind speed during application, help further reduce the potential for spray drift. Spray drift is more likely to have an effect to non-target vegetation, including sensitive plants, than volatilization.

Individual plants could come into contact with and be harmed by spray drift. Effects of spray drift to individual plants could include non-lethal damage to vegetation or to reproductive structures, such as flowers or developing seeds. Depending on how much spray drift contacted the plant, damage could be minimal and transient; in which case the plant would quickly recover. Conversely, drift that

covered a plant could severely injure it or even kill it. However, the probability of spray drift affecting an entire population is very low; effects would most likely to occur to individual plants or small groups of plants.

The possibility of herbicide movement in soil depends on a number of factors, including properties of the herbicide selected for use, site-specific conditions (such as topography, soil type and depth to the water table) and the climatic regime (e.g. annual precipitation and season of highest precipitation). Motility varies among herbicides; some are highly mobile in soil while others are not (SERA 2011 a-d, 2010, 2007 a-b, 2004 a-f). Picloram, for example, can be highly mobile in soil depending on site conditions while glyphosate is not mobile. Herbicide is more likely to move in soil on steep slopes and on porous soils, especially soils with little organic matter. Areas with high annual precipitation are usually more prone to the risk of movement than arid climates, as are areas that experience high intensity rainstorms.

Herbicide could unintentionally be moved into water, whether through surface water flow that washes herbicide away (such as a high intensity rainstorm) or through downward movement through the soil profile. Herbicide label instructions provide measures to minimize the likelihood of herbicide movement, such as specifications on how close to water an herbicide may be applied. For example, the label for clopyralid notifies the applicator that “clopyralid is a chemical that can travel (seep or leach) through soil”. The label instructs the user not to apply clopyralid directly to water, to areas where surface water is present or to intertidal areas below the mean high water mark. The label also advises applicators not to apply this herbicide to soils with rapid permeability (i.e. sandy soils). Adherence to label direction minimizes the potential for herbicide to move into and with water. Most sensitive plant species that occur in the project area do not grow in wetland environments, with the exception of pink agoseris (Table 3-50). Pink agoseris populations do exist in areas with nearby invasive plant infestations and could potentially be affected through loss of vigor, biomass, or reproductive output. The likelihood of effects would be ameliorated by herbicide selection, application of the lowest effective use rate and treatment techniques to prevent pink agoseris plants from being exposed to herbicide. There is very little potential for SCNF sensitive plants to be affected by the movement of herbicide in water or soil.

In conclusion, while indirect means (e.g. volatilization, drift, movement in soil or water) of herbicides contacting individual plants or groups of plants of SCNF sensitive plant species cannot be completely discounted, the most likely way non-target vegetation would be impacted by herbicides is by direct spray.

Herbicide application can also have beneficial effects, via indirect improvements in plant community composition, function and structure as a result of invasive plant control. The first and most immediately observable indirect effect of invasive plant control is the reduction in cover, density and vigor of the invasive plant species. This results in an increased availability of water and nutrients that were previously claimed by the more competitive weeds (Bussan and Dyer 1999). As canopy cover of invasive plants is reduced, allowing native plants have greater access to sunlight for photosynthesis. Eventually native plants are able to regain vigor in the absence of competing invasive plants. Increased biomass and reproductive success are then possible, as is recruitment of new plants into the native plant community.

Mechanical Control

Mechanical control is a very labor intensive and expensive method of treating invasive plants and is best suited to small sites. Various methods of mechanical control have been shown to be quite effective in controlling or partially controlling some invasive plant species (Sheley 1994). Mechanical control methods are generally more effective in controlling tap-rooted species or those with shallow root systems. Mechanical control is seldom an effective means of controlling species with rhizomatous or stoloniferous root systems or those that can sprout from deep underground roots.

The effects of mechanical control may be variably beneficial or detrimental to sensitive plants. Mechanical control can be an effective choice for some sensitive plant populations when used as part of IWM. For example, invasive plants can be mechanically removed within the sensitive plant population and then herbicides can be sprayed outside the population to provide a buffer against re-invasion.

Removal of seed heads from invasive plants in and around sensitive plant populations can prevent the input of fresh seeds to the seed bank, helping to reduce the density of invasive plants within a sensitive plant population and allowing more growing space for sensitive plants.

However, mistakes can be made in plant identification when performing mechanical control and some individual sensitive plants could be killed. This incidental mortality could be due to proximity to target invasive plants or to occasional misidentifications, especially at the seedling stage, which can be more difficult to see than adult plants. Incidental mortality is more likely to occur when working with hand tools or power tools, as compared to handing pulling.

One of the effects of mechanical control includes soil disturbance. Churning of the seedbed turns up viable seeds that have been buried in the soil and can create a germination event from soil-banked seed. Soil disturbance can also potentially increase the risk of erosion. The scale of soil disturbance effects occurs only at a localized level since mechanical control is confined to small areas.

Mechanical invasive plant control may also increase the amount of bare ground. This can be detrimental, beneficial or a combination of both. Increased amounts of bare ground could result in a temporary increase in soil erosion, for example, during a high intensity rain event. The bare ground also provides a seed bed for the deposition of freshly produced seeds, whether these are from desirable species or from invasive plants. This bare ground effect is usually confined to very small areas since mechanical control is practiced only a small scale.

Rehabilitation and Restoration

Forest Service manual and handbook direction provides guidance on rehabilitation and restoration. “Rehabilitation” is defined as repairing ecosystem processes, productivity and services while “Restoration” is defined as more actively assisting the recovery of an ecosystem that has been degraded to the point it no longer has biotic integrity in terms of species composition and community structure (FSM 2070 2008).

Invasive plant control is a rehabilitative/restorative practice in itself, aimed at reducing or removing invasive plants and the bank of viable invasive plant seeds stored in the soil to promote the establishment and maintenance of native plants (FSM 2900 2011). An upward vegetative trend of

native plants, including sensitive plant species, helps meet the desired condition of plant communities in the SCNF.

After invasive plant control, natural recovery is preferred to restore ecosystem structure, function and productivity on sites degraded by invasive plants, especially in the case of sensitive plant species, which often have adaptions to highly specific habitat conditions. There would be no direct or indirect impacts to SCNF Sensitive plants anticipated since there would be no active restoration implemented in sensitive plant populations.

Current Action Summary

Sensitive plant species found in the SCNF may be impacted by herbicide and mechanical invasive plant control measures; individual plants or small groups could be damaged or killed, especially young plants that are difficult to detect. However, adverse impacts on populations would be negligible. Continued implementation of the current action would not contribute to a downward trend in populations or habitat quality for any of the SCNF sensitive plant species or lead to listing under the Endangered Species Act. Table 3-53 displays the determination of effects to habitat and sensitive plant populations by species as a result of implementing the Current Action alternative.

Table 3-53: Determination of Effects to Sensitive Plants' Habitat and Individuals Resulting from Alterniatives 2 through 5

Sensitive Plant Species	Invasive Plant Control Method			Effects to Habitat	Effects to Plants	Effects Determination
	Biological	Herbicide	Mechanical			
Pink Agoseris	No Impact	Potential Impact	Potential Impact	Some short-term adverse impacts, long-term beneficial	May impact individual plants or groups of plants	May impact individuals, but is not likely to cause a trend to federal listing or loss of viability (MIIH)
Lost River milkvetch	No Impact	Potential Impact	Potential Impact	Some short-term adverse impacts, long-term beneficial	May impact individual plants or groups of plants	MIIH
Lemhi milkvetch	No Impact	No Impact	No Impact	None	None	No Impacts
Meadow milkvetch	No Impact	Potential Impact	Potential Impact	Some short-term adverse impacts, long-term beneficial	May impact individual plants or groups of plants	MIIH
Whitecloud milkvetch	No Impact	Potential Impact	Potential Impact	Some short-term adverse impacts, long-term beneficial	May impact individual plants or groups of plants	MIIH
Seaside sedge	No Impact	Potential Impact	Potential Impact	Some short-term adverse impacts, long-term beneficial	May impact individual plants or groups of plants	MIIH
Flexible alpine collomia	No Impact	Potential Impact	Potential Impact	Some short-term adverse impacts, long-term beneficial	May impact individual plants or groups of plants	MIIH
Douglas' biscuitroot	No Impact	Potential Impact	Potential Impact	Some short-term adverse impacts, long-term beneficial	May impact individual plants or groups of plants	MIIH
Rockcress draba	No Impact	Potential Impact	Potential Impact	Some short-term adverse impacts, long-term beneficial	May impact individual plants or groups of plants	MIIH
Stanley's whitlow-grass	No Impact	No Impact	No Impact	None	None	No Impacts
Welsh buckwheat	No Impact	Potential Impact	Potential Impact	Some short-term adverse impacts, long-term beneficial	May impact individual plants or groups of plants	MIIH
Guardian buckwheat	No Impact	No Impact	No Impact	None	None	No Impacts
Sacajawea's biscuitroot	No Impact	Potential Impact	Potential Impact	Some short-term adverse impacts, long-term beneficial	May impact individual plants or groups of plants	MIIH

Sensitive Plant Species	Invasive Plant Control Method			Effects to Habitat	Effects to Plants	Effects Determination
Challis crazyweed	No Impact	Potential Impact	Potential Impact	Some short-term adverse impacts, long-term beneficial	May impact individual plants	MIIH
Lemhi penstemon	No Impact	Potential Impact	Potential Impact	Some short-term adverse impacts, long-term beneficial	May impact individual plants or groups of plants	MIIH
Salmon twin bladderpod	No Impact	Potential Impact	Potential Impact	Some short-term adverse impacts, long-term beneficial	May impact individual plants or groups of plants	MIIH
Whitebark pine	No Impact	Potential Impact	Potential Impact	Some short-term adverse impacts, long-term beneficial	May impact individual plants or groups of plants	MIIH
Marsh's bluegrass	No Impact	Potential Impact	Potential Impact	Some short-term adverse impacts, long-term beneficial	May impact individual plants or groups of plants	MIIH
Wavy-leaf thelypody	No Impact	Potential Impact	Potential Impact	Some short-term adverse impacts, long-term beneficial	May impact individual plants	MIIH
Stanley thlaspi	No Impact	Potential Impact	Potential Impact	Some short-term adverse impacts, long-term beneficial	May impact individual plants	MIIH
Idaho range lichen	No Impact	No Impact	No Impact	None	None	No Impacts

3.6.5.4. Alternative 3-Proposed Action

Direct and Indirect Effects

Biological Control

The direct and indirect impacts of biological control under Alternative 3 would be the same as those described under Alternative 2.

Herbicide Control

The direct, indirect and cumulative effects of herbicide application as implemented by Alternative 3 would be the same as those disclosed under Alternative 2, with two exceptions.

These exceptions include (1) the addition of three herbicides to the SCNF's approved herbicides list and (2) the use of helicopter aerial application.

Additional Herbicides

An additional three herbicides are proposed for use. These include aminopyralid, imazapyr, and imazamox. Table 2-10 displays the application rates and methods that would be used to implement Alternative 3. Of these three herbicides, aminopyralid and imazapyr could be used in and around SCNF sensitive plant populations. Imazamox would only be used in aquatic or water's edge applications and use of imazamox would have no direct or indirect impacts to SCNF sensitive plants.

Imazapyr is a non-selective herbicide (like glyphosate) that also has some soil residual capability (BASF 2012). It does not volatilize readily in the field. Since there is potential for direct and indirect effects to non-target plants, imazapyr would be applied only as a highly targeted, spot application in and around sensitive plant populations.

Non-target vegetation can be affected by residual herbicide activity (Bussan and Dyer 1999), such as that exhibited by imazapyr. Non-lethal damage could include reduced biomass, vigor, and reproductive success. Adherence to label direction, design criteria, and implementation of standard operating practices designed to protect sensitive plants would minimize the adverse impacts of imazapyr.

Aminopyralid is a low toxicity herbicide that provides excellent control of broadleaf invasive plant species in a number of different plant families (SERA 2007). It is in the same class of herbicides as picloram and clopyralid and is most active on broadleaf plants in the sunflower and pea families. Aminopyralid has been proposed for use in the project area for several reasons. It is already in use in the FC-RONR Wilderness and has provided excellent control of invasive plant species such as spotted knapweed and rush skeletonweed. Aminopyralid is a low use rate herbicide and is of low toxicity to a number of different vegetation groups, including forbs in some plant families (e.g. borage and mustard families). Additionally, aminopyralid has extremely low volatilization pressure.

These characteristics make aminopyralid a good choice for use in and around SCNF sensitive plant populations. For example, aminopyralid could be applied within populations of Salmon twin bladderpod, Stanley thlapsi, and wavy-leaf thelypody, which are all members of the mustard plant family, without direct or indirect adverse effects. If added to the list of SCNF herbicides, aminopyralid could replace picloram, which has harsher direct impacts, in many cases.

Aerial Application

The ability to use aerial application would help improve invasive plant control efforts in the project area. Treatment limitations (e.g. topography, slope, lack of water, remote sites, and associated high treatment costs) would be easier to manage with aerial application as an approved tool. Aerial application would provide integrated management on sites where there are no or few invasive plant control options currently available due to these treatment limitations. This is a particularly important consideration for invasive plant species for which there are no biological control agents available or for which available agents have not been effective in providing invasive plant control.

The proposal is to include aerial herbicide application using helicopters to approved treatment methods and use seven herbicides for aerial treatment. Table 2-10displays the herbicide use rates proposed for aerial application under Alternative 3.

The broadcast nature of aerial application would, in the short term, affect non-target vegetation across larger areas compared to ground-based broadcast or spot applications. For this reason, design criteria (Appendix I) and standard operating practices would be applied to reduce the effects of aerial application to non-target vegetation. These practices include selecting herbicides to which native plants display resistance, using the lowest effective application rate, spraying during seasons when native plants are dormant, or using physical barriers and practicing avoidance, when needed.

Of the SCNF sensitive plant species to which effects might occur, only Lemhi penstemon would potentially be impacted by aerial herbicide applications. One of the design criteria is no aerial

application of herbicides would be made in whitebark pine stands. Aerial applications are not proposed in wetland habitats, which is where pink agoseris and meadow milkvetch grow, therefore no direct or indirect adverse impacts would be anticipated. Aerial applications are not proposed in areas sparsely occupied by invasive plants, which would eliminate potential impacts to Challis crazyweed, flexible alpine collomia, Salmon twin bladderpod, Stanley thlapsi, wavy-leaf thelypody, and Welsh's buckwheat. There would be no direct or indirect adverse effects to any of these species resulting from aerial application of herbicides.

Lemhi penstemon, in contrast to the other SCNF sensitive plant species that are generally few in terms of population size and number, is broadly distributed in suitable habitat across the northern portion of the project area. It is also locally abundant within its range in years with favorable weather conditions (Stucki et al. 2013). For example, Lemhi penstemon in the vicinity of Indian Peak on the North zone was a visually and numerically dominant member of the native plant community in 2013 and 2014 (D. Schuldt, personal observation).

Lemhi penstemon would be the only SCNF sensitive plant species likely to be affected by implementation of aerial application. Due to its widespread distribution, it is not possible to attempt total avoidance of Lemhi penstemon plants in herbicide applications, as is the practice with most other SCNF sensitive plant populations. For this reason, and because aerial application is a broadcast application, there is potential for aerial herbicide applications to directly and indirectly impact Lemhi penstemon.

The ability to make aerial herbicide applications in the SCNF would counteract landscape-level vectors of invasive plants into Lemhi penstemon habitat. However, it would also result in the injury or mortality of some Lemhi penstemon plants if present in the treatment area. This is representative of the trade-offs that have to be made when considering invasive plant control options.

The direct and indirect impacts of herbicide on susceptible plant species is the same regardless of the application method (e.g. broadcast application vs. spot application); it is rather a question of scale. A broadcast application results in herbicides being sprayed over the top of the vegetation across the entire area being sprayed. The result of aerial application to invasive plant infestations in plant communities occupied by Lemhi penstemon would result in plant injury or mortality to some plants. These effects can be reduced by herbicide selection (e.g. aminopyralid or clopyralid vs. picloram (Rice 2012)), use of the lowest effective use rate, timing (e.g. applying after Lemhi penstemon has flowered and is no longer in an active growth stage) and using the longest retreatment interval possible, consistent with invasive plant management objectives.

Short-term direct and indirect effects in sprayed areas could include reductions in abundance and cover, biomass, plant vigor and longevity, and reproductive success (Rice 2012). However, since Lemhi penstemon is broadly distributed and populations in the SCNF are secure, aerial application of herbicides in habitat suitable for Lemhi penstemon would have no long-term deleterious effects that would lead toward ESA listing.

Aquatic Application

There are no SCNF sensitive plant species that grow in aquatic settings. Neither aquatic nor water's edge applications would have any effects- direct, indirect, or cumulative- to SCNF sensitive plants.

Mechanical Control

The direct, indirect, and cumulative effects of mechanical control under Alternative 3 would be the same as those described under Alternative 2.

Rehabilitation and Restoration Practices

The direct and indirect effects of rehabilitation/restoration measures under Alternative 3 would be the same as those described under Alternative 2.

Implementation of Alternative 3 would not contribute to a downward trend in populations or habitat quality for any SCNF sensitive plant species or lead to listing under the Endangered Species Act. Table 3-53 displays the determination of effects to habitat and sensitive plant populations by SCNF sensitive plant species as a result of implementing the all action alternatives.

3.6.5.5. Alternative 4-No Aerial Herbicide Application

Direct and Indirect Effects

The direct and indirect effects as implemented by Alternative 4 would be the same as those disclosed under Alternative 3, Proposed Action, with the exception that there would be no aerial application of herbicide. The only difference in environmental consequences between Alternative 3 and Alternative 4 is that there would be a lesser impact on Lemhi penstemon populations in invasive plant-infested areas that could have been treated aerially.

Implementation of Alternative 4 would be beneficial overall since it would permit the use of new, less toxic and more selective herbicides. In the long-term, preventing invasive plants from spreading into presently uninfested areas, slowing the rate of spread of existing infestations and reducing the density of invasive plants in existing infestations would prove beneficial to SCNF sensitive Plants.

SCNF sensitive plant species may be impacted by herbicide and mechanical invasive plant control measures; individual plants or small groups could be damaged or killed, especially young plants that are difficult to detect. However, adverse effects on populations would be negligible. Implementation of Alternative 4 would not contribute to a downward trend in populations or habitat quality for any SCNF sensitive plant species or lead to listing under the Endangered Species Act.

3.6.5.6. Alternative 5-No Aquatic Herbicide Application

Direct and Indirect Effects

The direct and indirect effects as implemented by Alternative 5 would be the same as those disclosed under Alternative 3, Proposed Action, with the exception that there would be no herbicide treatment of aquatic invasive plants. There would be no difference in environmental consequences to sensitive plant populations between Alternative 3 and Alternative 5 as there are no aquatic sensitive plant species listed for SCNF.

Implementation of Alternative 5 would be beneficial overall since it (a) would permit the use of new, less toxic and more selective herbicides and (b) would permit the use of aerial application on

invasive plant infestations that presently uncontrolled or poorly controlled. In the long-term, preventing invasive plants from spreading into presently uninfested areas, slowing the rate of spread of existing infestations and reducing the density of invasive plants in existing infestations would prove beneficial to SCNF Sensitive Plants.

SCNF sensitive plant species may be impacted by herbicide and mechanical invasive plant control measures; individual plants or small groups could be damaged or killed, especially young plants that are difficult to detect. However, adverse effects on populations would be negligible, even with the addition of aerial application which would affect Lemhi penstemon occupying aerial treatment areas (Rice 2012). Implementation of Alternative 5 would not contribute to a downward trend in populations or habitat quality for any SCNF sensitive plant species or lead to listing under the Endangered Species Act (Table 3-53).

3.6.5.7. Cumulative Effects for All Action Alternatives

Biological Control

There are few cumulative effects to SCNF sensitive plant populations resulting from the use of biological control agents. However, in an IWM program, multiple invasive plant control techniques are used in combination. One potentially beneficial cumulative effect of biological control agents, used in conjunction with other invasive plant control measures, could be a more rapid reduction of invasive plant density and distribution in SCNF sensitive plant populations. This would result in a reduced need for invasive plant control treatments, such as mechanical or herbicide treatments.

There is little likelihood of adverse cumulative effects arising from the use of biological control agents. One potential adverse effect could be the natural movement of biological control agents dispersing naturally across national boundaries from countries where requirements regarding host specificity are less stringent. There is one such case from Canada, where a biological control agent intended to control houndstongue was found to cross over from houndstongue and feed on native members of the borage plant family. There is usually no way to remove biological control agents from natural settings once they have been released, have established, and are naturally dispersing. In this case, however, there are no SCNF sensitive plants species within the project area that are in the borage family.

Herbicide Control

It is unknown whether SCNF sensitive plant species occur on private lands in Butte, Custer, and Lemhi counties. Much private land is under agricultural production and no longer supports native plant communities. FS sensitive plant species are not federally protected, and while private landowners may be encouraged to conserve native plants, they are not required to do so or to alter land use practices that support their business.

The same is largely true of county lands, of which there is only a small amount in Butte, Custer, and Lemhi counties. County land is often dedicated to supporting county uses and infrastructure. It has often been converted from native vegetation to serve county needs. For example, county material sources are managed to provide materials needed for county road maintenance. Another example would be the airports that serve each county.

Other federal land management agencies, such as the BLM, may apply herbicides within or near populations of sensitive plant species that occur on BLM lands. BLM follows much the same standards for protecting rare plants and maintaining or restoring rare plant habitat as the FS. Likewise, BLM operational practices for invasive plant control are similar to those practiced in the SCNF. Given this, it is unlikely that federal invasive plant management activity within or near sensitive plant populations would contribute to a downward trend in population numbers.

Invasive plant management activities are ongoing in the FC-RONR Wilderness to the west of the project area. The invasive plant management program in the FC-RONR Wilderness is very similar to invasive plant management in the SCNF project area. Populations of some SCNF sensitive plant species are located in the FC-RONR Wilderness. Invasive plant control standard operating practices in the FC-RONR Wilderness for SCNF sensitive plant populations are the same as those in the project area. These standards, such as spot spraying, provide protection to sensitive plants while accomplishing invasive plant management objectives. There would be no cumulative detrimental impacts to SCNF sensitive plants.

Within the project area, the SCNF invasive plant management program has responsibility for herbicide applications made in SCNF, with one exception. Herbicide applications, including those made by contractors and partners, are conducted using standard operating practices that provide protection to sensitive plants while accomplishing invasive plant management objectives.

Only one SCNF sensitive plant species would potentially be impacted by herbicide applications not made under the control of SCNF. Several populations of flexible alpine collomia occur along Highway 93N inside the road corridor. Year-round open roads such as state highways typically re-infest with invasive plants on a constant basis due to continual traffic. This necessitates regular invasive plant surveys and control to maintain the corridor in an invasive plant-free condition. The state of Idaho has responsibility for invasive plant control along state highways annually where invasive plant distribution and density are very low. While the amount and type of annual herbicide application along Highway 93N are not known, the impacts to populations of flexible alpine collomia are likely negligible, if any. Invasive plant density and distribution is low and flexible alpine collomia grows in areas of talus rock, where spotted knapweed is not usually found.

Mechanical Control

There is little likelihood of cumulative effects arising from mechanical invasive plant control in sensitive plant populations. SCNF sensitive plant populations are mapped and made known to invasive plant management crews who plan invasive plant control treatments, including mechanical control, to protect sensitive plants. Likewise, when other ground-disturbing land use activities are planned (for example, mineral exploration), program managers check the NRIS database for the presence of known populations of SCNF sensitive plant species.

Rehabilitation and Restoration Practices

Cumulatively, any projects, especially those at the landscape level, could contribute to improved habitat conditions for SCNF sensitive plants. For example, completion of the recent SCNF travel management plan (USDA Salmon-Challis NF 2009) eliminated cross-country motor vehicle travel, which protects vegetation and soil resources, including sensitive plants.

Summary

The cumulative effects of invasive species control to SCNF sensitive plant species are the same overall for alternatives 2 through 5. The exception is the inclusion of aerial herbicide application as an approved method in Alternatives 3 and 5. Note that there would be no cumulative effects to SCNF sensitive plant species resulting from aquatic or water's edge herbicide applications for any of the action alternatives.

There would be no cumulative effects as a result of project implementation to four SCNF sensitive plants that do not occur in the project area. These include Lemhi milkvetch (Moseley 1989), Stanley's whitlow-grass (Moseley 1988), Guardian buckwheat (Moseley 1988) and Idaho range lichen (Cochrane 2014).

Table 3-54 displays possible cumulative effects to SCNF sensitive plant species present or potentially present in the cumulative effects analysis area. This table is derived from Appendix H which contains more specific information on past, present and reasonably foreseeable activities from SCNF that could potentially contribute to cumulative effects to sensitive plants.

Table 3-54: Potential Cumulative Effects from Human Uses/Activities and Invasive Plants

Common Name	General Human Use/Activity	Consequences
Pink agoseris	Domestic livestock grazing, fire suppression and fuels management, invasive plants and invasive plant control	Livestock grazing is identified as the primary threat (NatureServe 2013). Cumulative impacts could result from habitat degradation and loss or plant mortality.
Lost River milkvetch	Not applicable	There are no identified threats to habitat for this species (NatureServe 2013).
Lemhi milkvetch	Domestic livestock grazing	Domestic livestock and pronghorn antelope grazing is identified as the primary threat (NatureServe 2013). No cumulative effects from Alternatives 2 – 5.
Meadow milkvetch	Domestic livestock grazing, invasive plants and invasive plant control	Agriculture and livestock grazing are identified as the primary threats (NatureServe 2013). Cumulative impacts could result from habitat degradation and loss or plant mortality.
Whitecloud milkvetch	Domestic livestock grazing, recreation, roads and trails	Livestock grazing, recreational use and road/trail use are identified as threats (NatureServe 2013).
Seaside sedge	Not applicable	Threats have not been assessed by NatureServe. Fertig (1999) identified no threats, populations probably secure and species more abundant and widespread than previously believed.
Flexible alpine collomia	Mineral exploration and mining, road/trail maintenance, timber harvest, invasive plant control	Threatened by human disturbance of habitat and by invasive plants (NatureServe 2013). Cumulative impacts could result from habitat degradation and loss. Possibly loss of populations due to habitat loss from human disturbance.
Douglas' biscuitroot	Not applicable	NatureServe reports "absolutely no disturbances or threats to this narrow endemic" (2013, per R. Moseley)
Rockcress draba	Not applicable	Protected from human threats by inaccessible habitat (NatureServe 2013, Fertig 1999).
Stanley's whitlow-grass	Not applicable, does not occur in SCNF	Human-caused disturbance or threats absent or uncommon, all populations have good viability (NatureServe 2013).
Welsh's buckwheat	Domestic livestock grazing, mineral exploration and mining, recreation, road/trail use and maintenance, invasive plants and invasive plant control.	Threats have not been assessed by NatureServe. Murphy (2002) identifies livestock grazing, off-highway vehicle recreation and mining as threats to known populations and habitat, but of low magnitude. Cumulative impacts could result from habitat degradation and loss or plant mortality.
Guardian buckwheat	Not applicable, does not occur in SCNF	Human-caused disturbance or threats limited, all populations have good viability (NatureServe 2014).
Sacajawea's bitterroot	Not applicable	Threats have not been assessed by NatureServe. Habitat is isolated and occurs at high elevations, little information is available.
Challis crazyweed	Domestic livestock grazing, mineral exploration and mining, recreation, road/trail use and maintenance	Threats have not been assessed by NatureServe, but populations are apparently secure (NatureServe 2013).
Lemhi penstemon	Domestic livestock grazing, fire suppression and fuels management, mineral exploration and mining, recreation, road/trail use and maintenance, timber harvest, invasive plants and invasive plant control	NatureServe (2013) identifies various threats, including invasive plant invasion (specifically spotted knapweed) and invasive plant control, fire suppression, livestock grazing, logging and potential mining activity. Cumulative impacts could result from habitat degradation and loss or plant mortality.
Salmon twin bladderpod	Domestic livestock grazing, mineral exploration and mining, road/trail use and maintenance, invasive plants and invasive plant control	Mining, invasive plant invasion and invasive plant control, but good viability for known populations (NatureServe 2013). Cumulative impacts could result from habitat degradation and loss or plant mortality.
Whitebark pine	Not applicable	Common in suitable habitat, but threatened by disease and insect outbreaks, fire exclusion and climate change (NatureServe 2013).

Common Name	General Human Use/Activity	Consequences
Marsh's Bluegrass	Not applicable	Threats have not been assessed by NatureServe. Habitat is isolated and occurs at very high elevations.
Wavy-leaf thelypody	Mineral exploration and mining, recreation, road/trail use and maintenance	Roads, mining, off-road vehicle recreation, invasive plant invasion and control, livestock grazing and trampling (NatureServe 2013).
Stanley thlaspi	Mineral exploration and mining, recreation, road/trail use and maintenance	Threats have not been assessed by NatureServe. Moseley (1988) found species to be common with no significant threats.
Idaho range lichen	Not applicable, does not occur in SCNF	Off-road vehicle recreation, livestock grazing and trampling, road construction, and other surface disturbance (NatureServe 2013).

3.7. Human Health

3.7.1. Introduction

This section analyzes the potential for adverse health effects to workers and members of the public resulting from implementation of the alternatives from both the impacts of invasive plants and the impacts of invasive plant control on humans. This includes treatment of invasive plants using herbicides, mechanical methods, and biological control agents.

Design criteria were developed to minimize or eliminate exposures of concern to workers and the public. The design criteria include aspects such as stringent safety measures, use of personal protective equipment, selective application methods, and public notification of treatment activities which are planned to avoid exposures at levels that could be of concern to workers and the public.

During scoping, commenters brought up concerns about the effects of herbicides on human health. While herbicides can be associated with human health hazards, the likelihood of harmful exposures under this project is very low. Workers and the public may be exposed to herbicides used to treat invasive plants under the proposed action alternative in this project; however, no exposure scenarios exceeding a threshold of concern are anticipated. This conclusion is based on risk assessments that analyze the chemistry of the herbicides considered for use and the mechanisms by which exposures of concern might occur. Risk assessments do not indicate that any person would be adversely affected in any way by these herbicides used in the manner proposed for this project.

3.7.2. Measurement Indicators

- Toxicity potential of herbicides being used
- Sufficiency of design criteria to protect human health

3.7.3. Compliance with Forest Plan and Other Relevant Direction

Safety standards for herbicide use are set by the Environmental Protection Agency (EPA), Occupational Health and Safety Administration, Code of Federal Regulations (40 CFR part 170), and individual states. In addition, several sections of the Forest Service Manual and Handbook (FSM 2150, FSM 2150 R4 supplement, FSH 2109.14, FSM 6709.11) provide guidance to the safe handling and application of herbicides.

The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) established the US system of pesticide regulation to protect applicators, consumers and the environment. The Forest Service is authorized by the FIFRA and the Cooperative Forestry Assistance Act to use pesticides for multiple-use resource management and maintenance of the quality of the environment as long as the actions comply with the National Environmental Policy Act and the Council on Environmental Quality regulations. Forest Service Manual (FSM 2150) and Forest Service Handbook (FSH 2109) provide direction on safe use of pesticides, including direction on storage and transport, and development of safety plans and emergency spill plans.

Both the Challis NF and Salmon NF LRMPs are silent in regards to standards and guidelines for human health. The action alternatives do comply with the standard and guidelines specific to invasive plant management; the No Action alternative does not comply with the LRMPs. The design criteria developed for all treat methods, the herbicides analyzed, and the application methods in all the action alternatives comply with Forest Service Manual and Handbook (FSM 2150, FSM 2150 R4 supplement, FSH 2109.14, FSM 6709.11) and FIFRA safety standard guidelines.

3.7.4. Methodology for Analysis

The effects of herbicide use depend on the toxicity of the herbicide, the level of exposure to that herbicide, and the duration of that exposure. Risk assessments evaluate the potential effects to non-target plants, wildlife, human health, soils, and aquatic organisms from the herbicides considered for use in the SCNF. The Forest Service contracted with Syracuse Environmental Research Associates, Inc. (SERA) to evaluate human health and ecological effects of herbicides using EPA studies and other peer-reviewed articles from the open scientific literature. Information from laboratory and field studies of herbicide toxicity, exposure, and environmental fate was used to estimate the risk of adverse effects to non-target terrestrial and aquatic organisms, humans, water, and soil.

In addition to the analysis of potential hazards to human health from the active ingredients in the herbicides, SERA Risk Assessments (RAs) evaluated available scientific studies of potential hazards of other substances associated with herbicide applications: impurities, metabolites, inert ingredients, and adjuvants. There is usually less toxicity data available for these substances (compared to the herbicide active ingredient) because they are not subject to the extensive testing that is required for the herbicide active ingredients under the FIFRA.

The risk assessments considered worst-case scenarios including accidental exposures and application at maximum label rates. Although the risk assessments have limitations (see discussion below), they represent the best science available. The risk assessment methodologies and detailed analysis is incorporated into references of conclusions about herbicide toxicology in this document.

Exposure Scenarios

For each human health assessment in a risk assessment, a set of general exposure scenarios based on the low, typical, and maximum label rates of the herbicides are analyzed. For workers, exposures analyses are based on the application method, application rate, and acres treated. For the general public, general exposure scenarios included coming in contact with sprayed vegetation and consuming contaminated fruit, fish, or water.

Accidental exposure scenarios are designed to be intentionally extreme. The worker exposure scenarios involve immersion of the hands for a one minute period and wearing contaminated gloves

for an hour at varying application rates. Accidental exposures of the general public are evaluated in three scenarios: a naked child is sprayed directly with an herbicide as it is being applied and no steps are taken to remove the pesticide from the child for one hour; a woman of child-bearing age is accidentally sprayed on her feet and legs and no attempt is made to remove the pesticide for one hour, and there is an accidental spill into a small pond where a young child consumes one liter of contaminated water soon after.

The plausibility of these scenarios is very low because trained applicators should practice proper hygiene and would never spray a person (the naked child and woman's legs) and in the event of a pond spill, precautions would be taken to prevent public access following a spill (reducing the chance of drinking the water and fishing).

The estimates of longer-term general exposure by consumption of contaminated water are based on estimated application rates and monitoring studies that can be used to relate levels in ambient water to treatment rates in a watershed. In most herbicide applications, however, substantial proportions of a watershed are not likely to be treated. The exposure scenarios based on longer-term consumption of contaminated vegetation assume that an area of edible plants is inadvertently sprayed and that these plants are consumed by an individual over a 90-day period. Wild foods that are commonly gathered by the public, such as huckleberries, occur incidentally on some portions of the Forest in areas that do not tend to have high densities of invasive plants.

Analysis Area

The analysis area for direct and indirect effects is the non-wilderness portion of the Salmon-Challis National Forest. Cumulative effects will be addressed at a county-wide level.

3.7.5. Affected Environment

Potential Human Health Effects from Invasive plants

Some of the invasive plants found in the SCNF have compounds that can cause allergic reactions and others have spines, prickles, or sharp leaf margins that can cause scrapes, cuts, or skin irritation. Individuals who are allergic to plants can suffer symptoms ranging from mild- congestion, rashes, and localized itching; to severe- difficulty breathing or anaphylaxis.

Approximately 18 to 20% of the US population exhibit symptoms of allergic rhinitis or hay fever. Knapweed pollen is a common a powerful allergen that peaks in late July to early August. It can trigger severe reactions in sensitive individuals (Duncan and Clark 2005).

Leafy spurge contains a toxic compound in the latex which can cause primary chemical irritation resulting in dermatitis causing blisters and inflammation (Webster 1986). If the sap gets into the eye, it can cause inflammation of the cornea and result in sight threatening complications (Eke 1997). People who have contact with weeds, generally as a result of pulling them, are advised to wear gloves to protect against injury and reduce contact with compounds in the plants.

Potential Human Health Effects from Biological Treatments

Biological treatments would result in no known risks to human health.

Potential Human Health Effects from Chemical Treatments

Toxicity tests required by the EPA for pesticide registration include acute (short term) or chronic (longer term) exposures. Herbicides are subjected to long-term animal studies that test for effects and compliance with federal safety standards for human health. Toxicity tests required by EPA for pesticide registration include acute (short term) or chronic (longer term) exposures.

Acute toxicity can be a function of the amount of toxicant received, the route of administration, and the type of animal tested. Acute reactions tested include oral, dermal, and inhalation toxicity, and eye and dermal irritation. Table 3-55 displays acute toxicity categories for the assessed herbicides.

Chronic toxicity results from prolonged, repeated or continuous exposure to a chemical, typically at levels lower than those that cause acute toxicity. It often demonstrates a delayed response. Public concerns toward herbicides generally focus on potential chronic toxicity. Sublethal poisoning or exposure may be expressed by any of the following: skin/eye irritation; nervous system disorders; reproduction system disorders; damage to other organ systems (liver, kidney, lungs, etc.); birth defects; mutations; and cancer (Table 3-56).

The EPA evaluates carcinogenicity, teratology (birth defects), mutagenicity, and endocrine system disruption study results of herbicide effects to animals during the herbicide registration process. The study data is used to make inferences relative to human health. Table 3-55 displays the EPA Toxicity Categories while Table 3-56 displays acute effects of assessed herbicides, and Table 3-57 displays chronic effects of assessed herbicides. Data are from the respective SERA reports (Table 3-1), Bunch et al. 2012, Gervais et al. 2008, Henderson et al. 2010, and NPIC 2002.

Table 3-55: EPA Toxicity Categories (EPA 2012a)

Toxicity Category	Signal Word	Toxicity Classification	Oral (mg/kg)	Dermal (mg/kg)	Inhalation (mg/L)	Eye Irritation	Skin Irritation
I	DANGER Poison	High	0 –50	0 –200	0 – 0.2	Corrosive: corneal opacity not reversible within 7 days	Corrosive
II	WARNING	Moderate	>50 - 500	>200 – 2,000	>0.2 – 2.0	Corneal opacity reversible within 7 days; irritation persisting for 7 days	Severe irritation at 72 hours
III	CAUTION	Low	>500 – 5,000	>2,000 –20,000	>2.0 – 20	No corneal opacity; irritation reversible within 7 days	Moderate irritation at 72 hours

Toxicity Category	Signal Word	Toxicity Classification	Oral (mg/kg)	Dermal (mg/kg)	Inhalation (mg/L)	Eye Irritation	Skin Irritation
IV	NONE	Very Low	>5,000	>20,000	>20	No irritation	Mild or slight irritation at 72 hours

Table 3-56: Human Hazards Based on Acute Toxicity Categories

Herbicide	Acute Oral Toxicity	Acute Dermal Toxicity	Acute Inhalation	Primary Eye Irritation	Primary Skin Irritation
2,4-D amine	Moderate	Moderate	Low	High	Very Low
Aminopyralid	Very Low	Very Low	Very Low	Very Low	Very Low
Chlorsulfuron	Very Low	Low	Low	Low	Very Low
Clopyralid	Low[1]	Low	Low	Moderate	Very Low
Dicamba	Low	Low	Very Low	Moderate	Moderate
Glyphosate	Low	Low	Low	Low	Very Low
Imazamox	Very Low	Very Low	Very Low	Moderate/ Very Low[2]	Very Low
Imazapic	Very Low	Very Low	Low	Low	Very Low
Imazapyr	Very Low	Very Low	Low	Low	Very Low
Metsulfuron-methyl	Very Low	Low	Moderate	Low	Low
Picloram	Low	Low	High	Low	Very Low
Sulfometuron methyl	Very Low	Very Low	Low	Low	Low
Triclopyr TEA	Low	Low	Low	High	Low

[1] Low for technical grade, which is not used by the USFS; very low for formulation used by USFS
[2] Moderate for technical grade, very low for formulation used by USFS

Table 3-57: Human Hazards Based on Chronic Toxicity Categories

Herbicide	Carcinogen	Teratogen	Reproductive	Mutagen	Endocrine Disruptor
2,4-D amine	Not classifiable	Unlikely	Unlikely	Unlikely	Unknown
Aminopyralid	Not likely to be carcinogenic	No Effects	No Effects	No Effects	No Evidence
Chlorsulfuron	Evidence of non-carcinogenicity	No Effects	No Evidence	No Effects	No Evidence
Clopyralid	Evidence of non-carcinogenicity	No Effects	No Effects	No Effects	No Evidence

Herbicide	Carcinogen	Teratogen	Reproductive	Mutagen	Endocrine Disruptor
Dicamba	Not classifiable	Unlikely	No Effects	No Effects	No Information
Glyphosate	Evidence of non-carcinogenicity	Unlikely	Unlikely	No Effects	Unlikely
Imazamox	Not likely to be carcinogenic	No Effects	No Effects	No Effects	No Evidence
Imazapic	Evidence of non-carcinogenicity	No Effects	No Effects	No Effects	No Evidence
Imazapyr	Evidence of non-carcinogenicity	No Effects	No Effects	No Effects	No Evidence
Metsulfuron methyl	Not likely to be carcinogenic	No Effects	No Effects	No Effects	No Evidence
Picloram	Evidence of non-carcinogenicity	No Effects	No Effects	No Effects	No Effects
Sulfometuron methyl	No evidence of carcinogenic activity	Unlikely	Unlikely	No Effects	No Evidence
Triclopyr TEA	Not classifiable	No Effects	No Effects	No Effects	No Evidence

No Effects = No effects have been shown in laboratory tests and is not considered a hazard to humans.
Unlikely = Inconsistent or isolated effects have been shown in laboratory tests and it is not considered a hazard to humans at expected exposure levels.
Unknown = Laboratory tests are inconclusive or further testing is required.
Not Classifiable= Inadequate evidence of carcinogenicity or for which no data are available.

All herbicide applicators are required to follow the label directions for application rate and usage. The herbicide label is the primary communication on how to safely handle and use the product. It reflects the numerous scientific studies and regulatory reviews generated by the EPA registration process, which provides reasonable assurance that the potential benefits of use outweigh any potential risks: that, when used according to label directions, it will not cause unreasonable adverse effects on humans, fish and wildlife, or the environment. The law requires herbicide users to read and follow label specifications. The FIFRA, as currently amended, allows use of an herbicide at rates up to those approved on the label.

In addition to following label directions, the Forest Service requires an additional level of risk assessment. The inherent hazard (toxicity) of the herbicide, an estimate of exposure, and the response of the individual organism under consideration to that exposure (dose-response) are modeled to generate an estimate of risk (hazard quotient) for each scenario. The herbicides in this analysis are compared based on the hazard quotient (HQ), which is the ratio between the estimated dose (the amount of herbicide received from a particular exposure scenario) and the reference dose (RfD). When a predicted dose is less than the RfD, and the HQ (estimated dose/RfD) is less than 1.0, which is below the level of concern, then significant toxic effects are unlikely for that specific herbicide application. Table 3-58 displays scenarios in which HQs were exceeded.

Potential techniques to minimize human exposures to herbicides include selecting herbicides with low toxicity and using them at the lowest effective application rate to achieve the project's objective; using application methods that minimize off-target movement and non-target exposures; using buffer areas for streams for certain herbicides; providing personal protective equipment for applicators; and posting treated areas to inform the public. Treatments under all alternatives would be accomplished according to strict safety and health standards as required by EPA pesticide regulations which are listed as instructions for appropriate use on herbicide label.

Table 3-58: Scenarios in Which Hazard Quotient Exceeded

Herbicide	Workers- Acute	Workers-Chronic	Public-Acute	Public-Chronic
2,4-D amine	Yes	Yes	Yes	Yes
Aminopyralid	No	No	No	No
Chlorsulfuron	No	Yes	Yes	No
Clopyralid	No	No	Yes	No
Dicamba	No	Yes	Yes	Yes
Glyphosate	No	No	Yes	No
Imazamox	No	No	No	No
Imazapic	No	No	No	No
Imazapyr	No	No	No	No
Metsulfuron-methyl	No	No	No	No
Picloram	No	No	No	Yes
Sulfometuron methyl	No	Yes	No	No
Triclopyr TEA	Yes	Yes	No	Yes

2,4-D

Two acute RfDs were used in the assessment; one for reproductive-age females derived from the basis of maternal toxicity (0.025 mg/kg/day), and one for male workers (0.067 mg/kg/day. The chronic RfD is the same for female and male workers (0.005 mg/kg/day). For workers, HQs in both acute and chronic scenarios which could result in adverse health outcomes could be exceeded. For chronic exposure, at the typical application rate of 1 lb a.e./acre, HQs for backpack and aerial spray methods would be 16, and ground broadcast would be 30. The acute accidental scenario of wearing contaminated gloves for one hour at all application rates and wearing contaminated gloves for one minute at the highest application rate resulted in a HQ exceedance of 15 to 94. The accidental spill on the lower legs at a high application rate (4 lb a.e./acre) also exceeded the HQ by 1.8. The magnitude of the HQ is linearly related to the application rate.

HQs for both chronic and acute scenarios were exceeded for scenarios involving the public. For acute accidental exposures, the naked child scenario would be exceeded by 3 at the lowest application rate (0.5 lb a.e./acre) to 28 at the highest application rate. For consumption of contaminated water by a child, HQs are exceeded by 41, 82, and 328 for the lowest, typical, and highest application rates. The other acute scenario that exceeded HQs was that of an adult female eating contaminated fruit (4, 7, and 30 at the lowest, typical, and highest applications rates) and vegetation (27, 54, and 216, respectively). For chronic exposure, the consumption vegetation over the long-term could have plausible adverse health effects. The HQ exceedance would be 19, 38, and 152 at the lowest, typical, and highest application rates.

Sensitive subgroups to 2,4-D exposure are children, especially those who are malnourished; women who are pregnant or who could become pregnant; individuals who are immune-compromised; and individuals having diseases that affect the integrity of the cell membrane. Sunscreens can also increase the absorption of 2,4-D into the skin (USDA Forest Service 2006).

Aminopyralid

No exposure scenarios for workers, both acute and chronic, exceed the RfD. The hazard quotients for all application methods are below the level of concern by factors of 33 to 200.

For chronic public exposure scenarios, hazard quotients at the highest application rates are below the level of concern by factors of 100 to 125,000. Acute exposure for consumption of contaminated produce are below the level of concern by factors of 10 to 50 and non-accidental exposure involving contaminated water are below the level of concern by factors of 50 to 500. The accidental exposure scenario of a child consuming contaminated water resulted in a hazard quotient of 0.6, which is below the level of concern.

There is no information to suggest that specific groups or individuals may be sensitive to systemic effects of aminopyralid. Aminopyralid is a new herbicide and available information is limited to studies that are required for pesticide registration; however, nothing has raised substantial concern. Risks to the public or workers are not anticipated resulting from the application of aminopyralid (SERA 2007).

Chlorsulfuron

For chronic exposure for workers, the upper range of hazard quotients is below the level of concern for all backpack and aerial applications, but is somewhat above the level of concern for ground broadcast at the maximum label application rate. No acute accidental scenarios resulted in a HQ that exceeded the level of concern.

For public exposure, the only scenario to slightly exceed the level of concern is the consumption of water after an accidental spill of a large amount of chlorsulfuron into a small pond. This is not likely to be toxicologically significant or result in adverse effects. No other scenario, acute or chronic, would exceed the HQs.

There is no information to suggest that specific sub-groups or individuals may be sensitive to this chemical. There is no data to assess if chlorsulfuron will interact synergistically or antagonistically with any other herbicide. No additives in formulations are classified as toxic. There is no indication that repeated exposure would exceed a toxicity threshold (SERA 2004a).

Clopyralid

For workers, none of the acute or chronic exposure scenarios exceeded the HQ level of concern at the any application rate.

For public exposure, the only scenario to slightly exceed the level of concern is the consumption of water after an accidental spill of a large amount of clopyralid into a small pond. This is not likely to be toxicologically significant or result in adverse effects. No other scenario, acute or chronic, would exceed the HQs. The use of clopyralid does not appear to pose any risk of systemic toxic effects to workers or the general public in Forest Service programs.

There is no information to suggest that specific sub-groups or individuals may be sensitive to this chemical. It is unclear if individuals with pre-existing diseases of the kidney, liver or blood would be particularly sensitive to clopyralid exposure; however, individuals with any severe disease may be considered more sensitive to any chemical exposure. There is no data to assess if clopyralid will interact synergistically or antagonistically with any other herbicide. No additives in formulations are classified as toxic. There is no indication that repeated exposure would exceed a toxicity threshold (SERA 2004b).

Dicamba

At the typical application rate for ground-based broadcast applications (0.3 lbs a.e./acre), the upper range of the HQ for chronic exposure is reached, but not exceeded. For backpack and aerial applications, the level of concern is exceeded at application rates over 0.6 lb/acre. At typical application rates, no accidental acute exposure would exceed the level of concern. However, at the maximum application rate (2 lbs/acre), workers would be exposed to levels of dicamba that would not be considered acceptable, although it would be uncertain if noticeable effects would occur.

For the acute accidental exposure scenarios for the public, the naked child and consumption of contaminated water after a spill at typical and above application rates exceeded the level of concern for the hazard quotient. At the highest application rate, the acute scenarios of the lower legs of the woman sprayed, the consumption of fruit, and the consumption of fish by subsistence populations, all exceed the level of concern. None of the chronic exposure scenarios at the typical application rate exceed the level of concern. At the highest application rate, the level of concern was exceeded for the consumption of contaminated vegetation.

The only sensitive sub-group identified for dicamba is children. The scenarios analyzed include effects on children. There is no evidence that dicamba interacts with other compounds (SERA 2004c).

Glyphosate

The hazard quotient for accidental acute worker exposure scenario is below the level of concern by a factor greater than 300. For chronic worker exposures, the all hazard quotients are below levels of concern. To reach a level of concern (HQ=1) for aquatic applications, a worker would have to treat more than 250 acres in a single day, which is not plausible.

For the public, the acute exposure scenario of eating contaminated produce applied at the rate of 8 lbs/acre would result in a hazard quotient of 5.6. There is no basis for asserting that the dose related to that exposure level would result in gross signs of toxicity or lethality, but may raise concerns for adverse health effects in pregnant women. This is not a plausible exposure scenario for the applications being analyzed, since food crops are not being treated. Aquatic applications all have hazard quotients that a below the level of concern by a factor of 100.

Glyphosate breaks down into a metabolite and impurities. The metabolite present in the formulations used by the Forest Service is aminomethyl phosphonate (AMPA). Mammalian exposures to this metabolite are encompassed in existing glyphosate toxicity data. As far as it being an environmental metabolite, it has been determined that AMPA is not of toxicological concern by the EPA. Glyphosate contains NNG (N-nitrosoglyphosate) as an impurity. The EPA has concluded that the NNG content present in glyphosate is not toxicologically significant (SERA 2011a).

Glyphosate inhibits some cytochrome P450 isozymes (aromatase). The inhibition of these enzymes could enhance or diminish the toxicity of other compounds dependent on whether metabolism increases or decreases toxicity of those compounds (SERA 2011a). The impact of an added surfactant for aquatic applications is directly proportional to the surfactant's toxicity and concentration. Use of lower application rates while keeping the concentration of the surfactant constant would decrease the impact of the surfactant relative to high application volumes (SERA 2011a).

The International Agency for Research on Cancer determined that glyphosate should be classified as "possibly carcinogenic to humans" based on reviews of existing studies rather than new research (Guyton et al. 2015). In 1991, the US EPA concluded that glyphosate has "evidence of non-carcinogenicity" (Table 3-57), based on lack of evidence and the criteria used by the US EPA for classifying a carcinogen. The USFS defers to the US EPA in cases such as this. A new risk assessment is expected later this year; if the US EPA adopts the IARC recommendation and reclassifies glyphosate, then the USFS would consider updating risk assements and the reclassification would be considered "new information" for the purposes of NEPA (Bakke 2015).

Imazamox

No exposure scenarios for workers or the public resulted in a hazard quotient that exceeded or approached a level of concern. The use of imazamox is not likely to possess any identifiable risks to humans.

Imazapic

The worker exposure scenarios, acute and chronic, did not result in hazard quotients that exceeded a level of concern. A level of concern could be reached by wearing contaminated gloves at the maximum application rate for a longer period of time than the scenarios call for. Imazapic is also mildly irritating to the eyes. These effects are mitigated by wearing proper PPE and following proper handling practices. For public, none of the long term exposure scenarios result in a hazard quotient that exceeds a level of concern. For acute/accidental scenarios, the only one that reaches a level of concern is drinking contaminated water after a spill into a small pond. There is no information to suggest that that specific groups or individuals may be especially sensitive to systemic effects of imazapic (SERA 2004d).

Imapzapyr

No exposure scenarios for workers or the public resulted in a hazard quotient that exceeded or approached a level of concern. The use of imazapyr is not likely to possess any identifiable risks to humans (SERA 2011b).

Metsulfuron methyl

No exposure scenarios for workers or the public resulted in a hazard quotient that exceeded or approached a level of concern. There is no information to suggest that that specific groups or individuals may be especially sensitive to systemic effects of metsulfuron methyl (SERA 2004e)

Picloram

For workers, none of the acute or chronic exposure scenarios exceeded the HQ level of concern at any application rate.

For public exposure, the only scenario that resulted in a HQ greater than 1 was the long-term consumption of contaminated vegetation at the maximum application rate of 1 lb a.e./acre. This would be an unlikely scenario, since vegetation would have visible damage after being sprayed with picloram.

There is no information to suggest that specific sub-groups or individuals may be sensitive to this chemical. One study implicated 2,4-D in combination with picloram may cause reproductive impairment in mice. A study indicates that a commercial mixture of picloram and 2,4-D may impact immune function in rats; however, the study does not allow for an evaluation of any potential interactions between picloram and 2,4-D (SERA 2011c).

Sulfometuron methyl

At the typical application rate (0.045 lbs/acre), no acute or chronic scenarios exceed the level of concern for workers. At the maximum label application rate, backpack, ground broadcast, and aerial application methods all slightly exceeded the level of concern. If the assumptions are changed (highest application rate, highest number of acres treated per day, and good hygiene practices utilized) there would be no indication that workers would be at risk of sustaining systemic toxic effects. No accidental acute scenarios exceeded the level of concern at the highest application rate.

None of the acute or chronic scenarios involving the public resulted in an exceedance of the level of concern at any application rate.

There have been no sensitive sub-groups identified; however, there is speculation that individuals with existing thyroid dysfunction may be at increased risk. There is no evidence that sulfometuron methyl would interact synergistically or antagonistically with any other herbicide (SERA 2004f).

Tricloypr TEA

For workers, none of the acute exposure scenarios exceeded the HQ level of concern at the typical application rate (1 lb a.e./acre). At the application rate of 1 lb a.e./acre and typical conditions of application, there is no indication that workers would be subject to hazardous levels of triclopyr at central estimates of exposure. At upper ranges of exposure, however, the level of concern would be exceeded. At the application rate of 6 lbs. a.e./acre, the level of concern for chronic exposure would be exceeded for all terrestrial application methods. None of the accidental exposure scenarios would exceed the level of concern at the typical application (1 lb a.e./acre) and the high application (6 lbs. a.e./acre) rates. At the maximum label application rate (9 lbs. a.e./acre), a rate that is rarely, if ever, used by the Forest Service, the accidental exposure scenario of wearing contaminated gloves for one hour would exceed the HQ level of concern for female workers. No accidental exposure scenarios would exceed the level of concern for male workers.

For the public exposure scenarios, the only acute scenario that would result in an exceedance of the level of concern (HQ=27) is a female of childbearing age eating contaminated vegetation after an application rate of 1 lb. a.e./acre. Aquatic applications of triclopyr do not present identifiable risks to workers or the public. Identified sensitive sub-groups are women of childbearing age. There could be a risk of potential adverse reproductive outcomes in women exposed to amounts of triclopyr above the level of concern. Individuals with kidney disease or those with multiple chemical sensitivity syndrome may be at higher risk; however, there is no literature supporting this conclusion.

A major metabolite of triclopyr is 3,5,6-trichloro-2-pyridinol (TCP) which is toxic to mammals and other species. The HQs for TCP are similar to those for triclopyr. The exposure scenario of a female of childbearing age eating contaminated vegetation at the application rate of 1 lb a.e./acre would exceed the level of concern. The upper bound acute HQs range from 2 to 15 (SERA 2011d).

Triclopyr is a relatively typical weak-acid auxin herbicide. Aminopyralid, clopyralid, and picloram are similar in structure; the way the chemical is absorbed, distributed, metabolized, and eliminated; and toxicity; therefore, there is a reasonable anticipation that exposure to triclopyr and these other weak-acid herbicides may result in additive risks (SERA 2011d).

Drift and Volatilization

Herbicides can move through the atmosphere through spray drift, which occurs during herbicide application, and volatilization, which occurs after application. Volatility is dependent on the physical properties of the herbicide, primarily vapor pressure, while spray drift is dependent on the sprayer parameters such as nozzle orifice size, boom height and pressure, and wind speed (Branham and Hanson 1987).
Volatilization is the conversion a liquid or solid chemical to a gas. The amount of volatilization that occurs is dependent upon climactic and microclimatic conditions. Soil moisture is the primary environmental condition that influences the rate at which herbicides volatilize; in general, herbicides volatilize more rapidly from moist soils than dry soils (Menalled and Dyer 2005). Volatilization also increases with higher air and soil temperatures and increasing wind speed. The use of surfactants can change the volatility of an herbicide (Lincoln Co. unk.). Ester formulations of herbicides have higher vapor pressures and volatilize more than amine formulations (Nice et al. 2004). No ester formulations are proposed for use in this analysis.
Studies that have looked at the risk to the public from pesticide volatilization have been conducted in residential areas near agricultural areas. The chemicals addressed in these studies are not any that are reviewed in this analysis (Kegley et al. 2009).

Spray drift is the movement of the herbicide, generally via spray droplets, from the target area to an unintended area. Spray drift can be reduced by increasing droplet size. This can be done by reducing spray pressure, increasing nozzle orifice size, using drift reduction nozzles, rearward nozzle orientation during aerial applications, and the addition of adjuvants to the mixture. Other factors that influence spray drift are the method of application- drift is generally greater from mist blower and aerial applications than ground application; the distance between the nozzle and target (less distance will reduce drift); wind direction and wind speed; air stability; and temperature and humidity (low humidity and high temperatures causes rapid evaporation, which reduces the size of droplets). The influence of humidity and temperature is not always predictable, however (Dexter 1993).

Spray drift cannot be completely eliminated; however, with proper management, drift levels can be minimized to levels that do not cause harm (Felsot 2001). The methods to reduce drift potentials of herbicides considered for aerial application are discussed below.

Aminopyralid

For aerial applications, liquid formulations of aminopyralid are applied through specially designed spray nozzles and booms that are designed to reduce turbulence and maintain large droplet size to reduce drift (SERA 2007). Applications may only be done under favorable weather conditions, which include wind speeds between 2 and 10 mph and not during temperature inversions. It should be

applied at rates of no less than two gallons (mixed) per acre; five gallons or greater are recommended. If electrostatic spray systems are used, then it can be applied at a rate of one gallon per acre (Dow AgroScience 2007).

No worker or public exposure scenarios in the risk assessment exceeded the RfD, and were below levels of concern by factors of 33 to 200 (SERA 2007).

Clopyralid

Clopyralid has been shown to have little potential for drift during aerial applications (DiTomaso et al. 2004). To reduce any possible drift, the label recommends using straight stream nozzles, use spray booms no longer than ¾ of rotor length, utilize drift control systems and drift control additives. Aerial applications should be conducted when wind velocity is low and not applied during temperature inversions (Dow AgroScience 2011a).

The only scenario to slightly exceed the level of concern is the consumption of water after an accidental spill of a large amount of clopyralid into a small pond. No other scenario, acute or chronic, for workers or the public, would exceed the HQs (SERA 2004b).

Imazapic

Aerial applications for Imazapic are to be conducted only by helicopter for Forest Service purposes. Approximately 40 to 100 acres per hour may be treated. Liquid formulations are applied through specially designed spray nozzles and booms that are designed to reduce turbulence and maintain large droplet size to reduce drift (SERA 2004d). To reduce or prevent drift, applications should not be made in windy or gusty conditions (applications should occur when wind speeds are between 3 and 10 mph), high temperatures, low humidity, or temperature inversions (BASF 2011).

No worker or public exposure scenarios in the risk assessment exceeded the RfD, and were below levels of concern by factors of 25 (SERA 2004d).

Picloram

Aerial applications for Picloram are to be conducted only by helicopter for Forest Service purposes. Approximately 40 to 100 acres per hour may be treated. Liquid formulations are applied through specially designed spray nozzles and booms that are designed to reduce turbulence and maintain large droplet size to reduce drift (SERA 2011c).

One exposure scenario exceeded the HQ; that of a person eating contaminated vegetation over the long-term. Aerial applications have the same exposure potential as backpack applications.

A study was done in the Missoula Valley that modeled the buffer zone necessary to ensure that potential exposure of the public would be well below any level that could be harmful. The simulation assumed a 10 mph wind for ground applications and a 6 mph wind for aerial applications.

illustrates the modeling results that indicate that buffer zones required resulting in no potential harm to a child are not substantial (Felsot 2001).

Table 3-59: Recommended Minimum Buffer (feet)

Application Method	One spray swath			20 spray Swath		
	Clopyralid	2,4-D	Picloram	Clopyralid	2,4-D	Picloram
Ground spray-low boom	0	5	0	0	5	0
Ground spray-high boom	0	15	0	0	30	0
Aerial spray-10-ft release	-	-	-	0	N/A	0
Aerial spray-25-ft release	-	-	-	0	N/A	0

Other Ingredients and Adjuvants

Inert (or other) ingredients and adjuvants are ingredients in an herbicide formulation other than the active ingredient. By law, the active ingredient must be identified on a product's label and the percentage by weight disclosed. Inert ingredients and adjuvants are substances that are intentionally added to an herbicide either in the commercial formulation or in the tank mixture. Their purpose is to influence the effectiveness of the active ingredient by doing such things as preventing caking or foaming, extending shelf-life, acting as surfactants, or assisting with the mixing and/or application of the herbicide. It is not required by law to disclose the name or percentage of the ingredients on the label or MSDS sheet, because the identity is considered proprietary information of the manufacturer (EPA 2011).

Some formulations of glyphosate contain the surfactant polyethoxylated tallow amine (POAE). The toxicity of formulations which contain the surfactant is greater than the toxicity of formulations which do not contain it. The SCNF does not propose to use the formulations of glyphosate which contain the POAE surfactant.

The EPA reviews the inert ingredients prior to registration. The lack of disclosure on the label of other ingredients in a formulation indicates that none of the inert ingredients present at a concentration of 0.1% or greater are classified as hazardous or toxic (SERA 2004a). The inclusion of certain ingredients in adjuvant formulations is regulated by the EPA, but the testing, the oversight of manufacture, and the use of adjuvants is not regulated consistently.

During the preparation of the SERA risk assessments, data on inert ingredients that was in the confidential business information (CBI) files or obtained under a FOIA request was reviewed. The exception was for 2,4-D, whose study predates FOIA availability (USDA Forest Service 2006). The herbicide formulations that had proprietary information released included inert ingredients that are on the EPA Inert List 4A: minimal risk ingredients (low toxicity or non-toxic); List 4B: other ingredients for which EPA has sufficient information to reasonably conclude that the current use will not adversely affect public health; or List 3: inert ingredients for which available toxicology data are insufficient to classify the compound as of toxicologic concern (List 1), possible toxicologic concern (List 2), or of minimal concern (List 4). No toxic substances were identified as being included in herbicide formulations.

The list of adjuvants commonly used in the SCNF is identified in Appendix D.

Potential Human Health Effects from Manual and Mechanical Treatments

Potential risks to human health can result from manual and mechanical invasive plant control methods. Adverse weather and terrain can cause unfavorable working conditions. Heat and cold-related illness can be hazardous. Steep and uneven terrain could increase the risk of tripping and falling resulting in strains, sprains, breaks, cuts, and abrasions or losing control of equipment. Tools and equipment have inherent danger such as sharp edges of blades, emissions from gasoline or diesel powered equipment, flying debris, and loud noises that could cause hearing damage. Ergonomic hazards resulting in musculoskeletal injuries could occur from carrying equipment and pulling invasive plants.

While there is some potential for health effects associated with mechanical treatment of invasive plants, required personal protective equipment (PPE) such as gloves, long sleeved shirts, boots, and safety glasses along with personal hygiene and appropriate and adequate training and supervision would prevent injuries or risk of exposure.

Potential Human Health Effects from Rehabilitation and Restoration Treatments

Potential human health risks associated with cultural control methods include exposure to dust and chaff during seeding operations. Allergic reactions can result from the exposure of seed chaff when handling seeds; however, gloves, long sleeved shirts, boots, and other PPE, as needed, would prevent injuries or irritations.

3.7.6. Environmental Consequences

3.7.6.1. Alternative 1-No Action

Direct and Indirect Effects

Alternative 1 would pose no human health risk from exposure to herbicides or other treatment methods because no invasive plant control activities would be initiated. Under this alternative, invasive plants would continue to spread in the SCNF which could impact individuals sensitive to invasive plant allergens.

Cumulative Effects

There would be no cumulative effects from treatment activities because no treatment activities would be undertaken in this alternative.

3.7.6.2. Alternative 2-Current Action, Alternative 3-Proposed Action, Alternative 4-No Aerial Herbicide Application and Alternative 5-No Aquatic Herbicide Application

Direct and Indirect Effects

Biological Treatments

Biological treatments would result in no known risks to human health.

Herbicide Treatments

Worker Exposure

Worker exposure to herbicides is affected by the application rate of the herbicide, the number of hours per day the herbicide is applied, the number of acres treated per hour, hygiene used, and personal protective equipment worn. During broadcast and spot treatments, workers can come into contact with herbicides primarily through exposed skin, but also through the mouth, nose, and lungs. Contact with herbicides may result in irritation to the skin and eyes.

The worker exposure scenarios involve immersion of the hands for a one minute period and wearing contaminated gloves for an hour at varying application rates. Of the thirteen herbicides prosed for use, eight did not have any scenarios involving workers that exceeded the level of concern. Five herbicides have scenarios that exceed the hazard quotient level of concern for workers at some rate of application. Four of those- chlorsulfuron, dicamba, sulfometuron methyl, and triclopyr- do not exceed any level of concern at typical application rates. One, 2,4-D, exceeded the chronic exposure level of concern at typical application rates.

Design criteria minimize all worker exposure scenarios by following safe work practices and label advisories.

Public Exposure

Exposure scenarios assume that a person has contact with the herbicide from direct spray, from skin contact with sprayed vegetation, or from consumption of contaminated fruit, water or fish. Scenarios in risk assessments were modeled for both acute and chronic exposure.

Of the thirteen herbicides proposed for use, six did not have any scenarios involving the public that exceeded the level of concern. Seven herbicides have scenarios that exceed the hazard quotient level of concern at some rate of application. One herbicide, picloram, has no scenarios that exceed the level of concern at the typical application rate. Two herbicides, chlorsulfuron and clopyralid, slightly exceed the level of concern only under the scenario where a large amount of chemical is spilled in a pond and water from the pond is consumed soon after. Dicamba has two acute scenarios; consumption of water after a spill and the spraying of a child, that exceed levels of concern at a typical application rate. Triclopyr has a chronic scenario that exceeds the level of concern of a female who eats vegetation that had been sprayed at a typical application rate. Glyphosate exceeded a level of concern for an acute scenario of consuming contaminated produce applied at the maximum rate. One herbicide, 2,4-D, had acute and chronic exposure scenarios that had HQ level of concern exceeded at typical, and lower, application rates.

The public exposure scenarios evaluated in the risk assessments are purposefully extreme. There is virtually no chance of a child or a woman of childbearing age to be directly sprayed during herbicide applications. Three herbicides, 2,4-D , glyphosate, and triclopyr, had exposure scenarios that exceeded a level of concern if fruit or vegetation containing herbicide residue were consumed shortly after application; 2,4-D also exceed the level of concern for vegetation consumed over the long-term. There is some edible forest product collection in the SCNF, but is not extensive. People who harvest and consume edible forest products may be exposed through directly handling contaminated plant material, then chewing or eating it. Such doses are unlikely to exceed a threshold of concern. All herbicides applied in the SCNF also have a dye added to the tank mixture,

so chemically treated plants are visually identifiable, which makes avoidance of those plants possible.

Design criteria would minimize public exposure by increasing notification of the public regarding areas that had herbicide applications. The general public would not be exposed to harmful levels of any herbicides used in the implementation of this project.

The risk assessment evaluated two hypothetical drinking water sources: 1) a stream, contaminated with herbicide residues by runoff or leaching from an adjacent herbicide application; and 2) a pond, into which a large amount of herbicide solution is spilled. The only herbicide scenarios of concern would involve a child drinking from a pond contaminated by a spill of a large tank of herbicide solution. The risk of a major accidental spill is not linked in a cause-and-effect relationship to how much treatment of invasive plants is projected for a particular herbicide; a spill is a random event. A spill could happen whenever a vehicle carrying herbicide passes a body of water. The potential risk of human health effects from large herbicide spills into drinking water are alleviated by design criteria that require all aspects of the Spill Plan to be implemented.

Manual and Mechanical Treatments

Potential risks to human health from mechanical invasive plant control methods are very low and include emissions from gasoline or diesel powered equipment, burns, allergies, back injuries, injuries from tools and equipment, and skin irritation from direct contact with plants by individuals doing the work.

Some invasive plants species can cause allergies and minor skin irritations in a few individuals. Some species of invasive plants, such as thistles, cause minor scrapes and irritations. There are other more serious complications that may result from hand pulling. For example, leafy spurge contains a latex-bearing sap that irritates human skin and rarely causes blindness in humans upon contact with the eye (Webster 1986, Eke 1997). Highly allergic individuals can have serious complications when exposed to allergens (weeds or pollen), including constriction of the airway and anaphylactic shock, which can be hazardous since forest workers would generally be working some distance from medical assistance.

While there is some potential for health effects associated with mechanical treatment of invasive plants, required personal protective equipment such as gloves, long sleeved shirts, boots, and safety glasses along with personal hygiene would prevent injuries or irritation. Therefore, no human health effects are anticipated by manual or mechanical removal of invasive plants.

Rehabilitation and Restoration Treatments

Potential human health risks associated with cultural control methods include exposure to dust and chaff during seeding operations. Allergic reaction can result from exposure of seed and chaff when handling seeds; however, gloves, long sleeved shirts, boots, and other personal protective equipment, as needed, would prevent injuries or irritations. Therefore, no human health effects are anticipated by cultural control methods.

Cumulative Effects

Cumulative effects are "the incremental impacts of the proposed action and alternatives when added to effects of other actions both on National Forest System lands and other adjacent federal, state, or private lands" (40 CFR 1508.7).

CEQ regulations do not require the consideration of the individual effects of all past actions to determine the present effects of past actions. In regard to past actions, the agency must determine what information regarding past actions is useful and relevant to the required analysis of cumulative effects during the scoping process and the preparation of the analysis. Dependent upon the proposed action, the accounting for past actions and specific information about the direct and indirect effects of their design and implementation could, in some contexts, be useful to predict the cumulative effects of the proposal. The CEQ regulations, however, do not require agencies to comprehensively list and analyze all individual past actions. Just because information about past actions may be available or obtained with reasonable effort does not mean that it is relevant and necessary to inform decision making (40 CFR 1508.7).

Human activities are known to have influenced the spread of invasive plants into North America, the Pacific Northwest and specific sites within the project area. A complete list of past actions is not necessary to understand how land uses have contributed to the current distribution of invasive plants. The baseline for cumulative effects analysis is the current condition.

A list of ongoing activities and foreseeable future projects are available in Appendix H. Many of these activities have the potential to introduce or spread noxious invasive plants. Permitted activities have stipulations, such as prevention measures included in grazing allotment annual operating instructions, timber sale contracts, and mineral material plans of operation. The recent update of the SCNF travel management plan eliminated cross country motorized travel, which eliminated a substantial potential for introducing or spreading noxious invasive plants. The maximum number of acres that would be treated- which are identified in the alternatives- would not change based upon these activities. The potential for cumulative effects resulting from treatment activities are discussed below.

Biological Treatments

No direct or indirect human health effects are anticipated to occur as a result of biological treatments; therefore no cumulative effects are anticipated to occur.

Chemical Treatments

Because of the manner in which the State of Idaho collects data regarding pesticide use is not possible to track which herbicides are used or in what quantity on private land. However, CWMA partners do track that information for their activities. Table 3-8 and Table 3-9 display the three-year average of applied acres of herbicide in Butte, Custer, and Lemhi Counties. Table 3-6 displays the three-year average of applied acres herbicide use on the Salmon-Challis portion of the Frank Church-River of No Return Wilderness Area (FC-RONR). The County CWMAs treat private, state, county and federally owned lands and provide herbicide to land owners. The numbers below display the acres of herbicide that were applied by the County CWMAs, not acres that were applied by private landowners. CWMA partners are licensed pesticide applicators, therefore herbicides were applied in compliance with label direction.

The SERA risk assessments identified connected actions and cumulative effects for each of the herbicides reviewed. In the risk assessments, connected actions include actions or the use of other chemicals which are necessary and in close association with the use of the analyzed herbicide. Cumulative effects are analyzed within the context of the Food Quality Protection Act, which requires the assessment of chemicals with a similar mode of action. It is beyond the scope of the risk assessments to identify and consider all agents that might interact with or cause cumulative effects with the analyzed herbicide.

2,4-D

Some studies suggest that 2,4-D in combination with other herbicides may cause synergistic effects. One study implicated 2,4-D in combination with picloram may cause reproductive impairment in mice. There is no evidence that inert compounds or impurities found in 2,4-D formulations would have a significant health risk (USDA Forest Service 2006).

2,4-D is a member of the alkylphenoxy herbicide class of pesticides. The EPA has not yet made a determination as to which compounds to which humans may be exposed, if any, have a common mode of toxicity. Interactions are likely to occur between 2, 4-D and other chemicals that affect cell membranes and cell metabolism. The risk assessment for long-term exposure, which addresses the potential impacts of cumulative effects, identified the potential for adverse health effects for workers and people consuming contaminated vegetation (USDA Forest Service 2006).

Aminopyralid

There is no basis to assert that impurities in or metabolites of aminopyralid are likely to result in effects not already included in the hazard quotients for human exposure scenarios.

The EPA has not made a common mechanism of toxicity finding for aminopyralid or any other substances. The risk assessment specifically considered the effects of repeated and long-term exposure, which address the potential impact of cumulative effects, and concluded that there was no basis for asserting that cumulative adverse effects were plausible (SERA 2007).

Chlorsulfuron

There is no data to assess whether chlorsulfuron will interact either synergistically or antagonistically with 2,4-D or any other herbicide.

The risk assessment specifically considered the effects of repeated and long-term exposure, which address the potential impact of cumulative effects, and concluded that there was no indication that a threshold for toxicity would be exceeded or for cumulative adverse effects to result (SERA 2004a).

Clopyralid

There are no data in the literature suggesting that clopyralid will interact, either synergistically or antagonistically with other compounds.

The risk assessment specifically considered the effects of repeated and long-term exposure. All long term exposure scenarios were substantially below the level of concern and should not be associated with cumulative adverse effects (SERA 2004b).

Dicamba

There is no substantial evidence that dicamba will interact with other compounds.

The risk assessment specifically considered the effects of repeated and long-term exposure. Long term exposure scenarios were below the level of concern and should not be associated with cumulative adverse effects (SERA 2004c).

Glyphosate

The most important connected action in the use of glyphosate is the use of surfactants. The use of formulas that contain POAE are not considered in this analysis.

It is possible that people could be exposed to multiple sources of glyphosate; however, the exposure scenarios indicate that multiple exposures do not exceed the level of concern. Currently the EPA does not have data at this time to determine whether glyphosate has a common mechanism of toxicity with other substances or how to include it in a cumulative risk assessment (SERA 2011a).

Imazamox

Imazamox formulations contain inert components and the metabolism involves the formation of other compounds. Based on the low hazard quotients derived from the exposure scenarios, there is not a plausible basis for suggesting that inerts, impurities, or metabolites will impact the risk characterization for human health effects.

Because imazamox and metabolic degradates have low toxicity, there is no concern regarding the potential for cumulative adverse effects with other substances with a common mode of action (SERA 2010).

Imazapic

The manufacturer recommends tank mixes with glyphosate and 2,4-D. No data are available for the combined toxicity with glyphosate and while the combination with 2,4-D is more toxic than with imazapic alone, that is likely due to the properties of 2,4-D.

The risk assessment specifically considered the effects of repeated and long-term exposure. Long term exposure scenarios were below the level of concern and should not be associated with cumulative adverse effects (SERA 2004d).

Imazapyr

Imazapyr formulations contain inert components and the metabolism involves the formation of other compounds. Based on the low hazard quotients derived from the exposure scenarios, there is not a plausible basis for suggesting that inerts, impurities, or metabolites will impact the risk characterization for human health effects.

Even though imazapyr is structurally similar to other imidazolinone herbicides (imazamox and imazapic), data do not support the conclusion that they share a common mechanism of toxicity and that the combined effect would result in cumulative effects. Because imazapyr has low toxicity, there is basis for enhanced concern for the potential for cumulative adverse effects (SERA 2011b).

Metsulfuron methyl

There are no data in the literature suggesting that metsulfuron methyl will interact, either synergistically or antagonistically with other herbicides.

The risk assessment specifically considered the effects of repeated and long-term exposure, which address the potential impact of cumulative effects, and concluded that there was no indication that a threshold for toxicity would be exceeded or for cumulative adverse effects to result (SERA 2004e).

Picloram

The technical grade formulation of picloram contains hexachlorobenzene, which exposure scenarios determined that the potential carcinogenic risk was below the level of concern. The use of technical grade picloram is not considered in this analysis.

Picloram does not appear to produce a toxic metabolite produced by other substances. For the purposes of the analysis, picloram is assumed to not have a common mechanism of toxicity with other substances. The risk assessment specifically considered the effects of repeated and long-term exposure and should not be associated with cumulative adverse effects (SERA 2011c).

Sulfometuron methyl

There are no data in the literature suggesting that sulfometuron methyl will interact, either synergistically or antagonistically with other herbicides.

The risk assessment specifically considered the effects of repeated and long-term exposure, which address the potential impact of cumulative effects, and concluded that there was no indication that a threshold for toxicity would be exceeded or for cumulative adverse effects to result (SERA 2004f).

Triclopyr

Triclopyr metabolizes into TCP which is toxic to mammals and other species. The exposure scenario of a female of childbearing age eating contaminated vegetation at the application rate of 1 lb a.e./acre would exceed the level of concern (SERA 2011).

Triclopyr is a relatively typical weak-acid auxin herbicide. Aminopyralid, clopyralid, and picloram are similar in structure; the way the chemical is absorbed, distributed, metabolized, and eliminated; and toxicity; therefore, there is a reasonable anticipation that exposure to triclopyr and these other weak-acid herbicides may result in additive risks (SERA 2011d).

The exposure scenarios in the risk assessment specifically addressed and encompassed the potential impact of the cumulative effects of repeated exposures to triclopyr for workers at high application rates and for women of child-bearing age who eat contaminated produce (SERA 2011d).Rehabilitation and Restoration Treatments

Manual and Mechanical Treatments

There is no data that identifies the level of manual and mechanical treatments that are conducted in the counties that encompass the proposed project area. No direct or indirect human health effects are anticipated to occur; therefore no cumulative effects are anticipated to occur.

Rehabilitation and Restoration Treatments

There is no data that identifies the level of rehabilitation and restoration treatments that are conducted in the counties that encompass the proposed project area. No direct or indirect human health effects are anticipated to occur; therefore no cumulative effects are anticipated to occur.

Summary

The total land mass of the three counties is 7,521,388 acres. The total known annual average acres of applied herbicide for Butte, Custer, and Lemhi Counties which is applied by CWMA partners is less than 5,000 acres, or 0.07% of the area. Private land makes up 8% of the counties. Even without knowing how much herbicide is applied to private land, the proportion of private land in relation to the three county-wide area is low. The applications of these herbicides are also spatially distinct. The herbicide applications identified in the alternatives would not be in the same locations as the applications identified in Table 3-60. None of the herbicides analyzed have an obvious cumulative adverse effects when used in combination with other herbicides. Effects from repeated exposures are discussed earlier and can be largely mitigated by proper use of PPE and good hygiene practices. Given the relatively small proportion of treatment across the landscape, the implementation of design criteria designed and utilized to protect workers and the public, and the use of label guidelines for proper application, cumulative adverse effects to human health are not expected from the implementation of any of the action alternatives.

Table 3-60: Ownership by County (Acres)

Ownership	Butte County	Custer County	Lemhi County	Total Acres
Private	182,822	180,709	243,794	607,325
State	13,272	55,335	39,640	108,247
BLM	515,678	803,541	576,687	1,895,906
DOE	330,690			330,690
NPS	120,018			120,018
USFS	271,753	2,121,884	2,065,565	4,459,202
Total Acres	1,434,232	3,161,470	2,925,686	7,521,388

3.8. Recreation

This section will describe the affected environment and analyze the effects of the proposed project and alternatives on the recreation resource and congressionally designated areas. The analysis will evaluate the impacts of invasive plant treatment methods on recreation with respect to the general forest area and developed recreation sites and trails. For the purposes of this discussion, congressionally designated areas include eligible and designated Wild and Scenic Rivers (WSR) and wilderness. The effects on the outstandingly remarkable values, water quality and free flowing characteristics of designated and eligible wild and scenic rivers, and the effects on wilderness character will be evaluated. Although the Frank Church River of No Return Wilderness area is specifically excluded from this proposal, the effects of the alternatives on the recreation resources within the "cherry stems and bubbles", those areas that are isolated corridors of non-wilderness surrounded by the wilderness area, will be addressed. Invasive plant treatment methods are described in detail in Overview of Alternatives portion of this report. Invasive plants can detract from the desirability of using recreation sites and participating in certain recreational activities. For example, stiff plant stalks, thorns, sharp bristles, and allergies created by invasive plants can prevent humans from walking, sitting, or setting up camp. They can also have a distinct effect upon the visual aspects of a given site, especially within the foreground and as the invasive plants become dominant within a stand of vegetation. Invasive plants also detract from the recreation experience by reducing the variety and abundance of native flora to observe or study, and reducing forage availability for wildlife and recreational stock.

Overall, recreation use on the Forest is considered light to moderate. According to the 2009 National Visitor Use Monitoring (NVUM) study, recreation use on the Salmon- Challis National Forest was estimated at 276,000 site visits. The top primary activities on the Salmon-Challis were hiking/walking, viewing natural features, relaxing, driving for pleasure, fishing and hunting. Big game hunting and fishing are very popular forest-wide. Recreation use associated with hunting such as off-highway vehicle (OHV) use, dispersed camping, wilderness and back country access using pack stock all increase substantially during the big game hunting seasons.

3.8.1. Measurement Indicators

- Effects to visual resources
- Effects to Wild and Scenic River (WSR) designated and eligible streams
- Effects to Idaho Roadless Areas

3.8.2. Compliance with Forest Plan and Other Relevant Direction

The Wild and Scenic Rivers Act (16 US 1271, PL 90-542) provides the general direction for management of these rivers. Wild, Scenic, and Recreational River Management Standards are included in the Forest Service Handbook (FSH) 1909.12 – Chapter 80 for interim management of eligible stream segments until a suitability determination can be made.

Idaho Roadless areas are undeveloped areas typically exceeding 5,000 acres that met the minimum criteria for wilderness consideration under the Wilderness Act and that were inventoried during the Forest Service's Roadless Area Review and Evaluation (Rare II) process, subsequent assessments,

Forest planning, and the Idaho Roadless Rule (36 CFR Part 294, Subpart C – Idaho Roadless Area Management, 2008).

The design criteria developed for all treatment methods, the herbicides analyzed, and the application methods in all the action alternatives comply with Forest Service Manual (FSM 2150, 2153, 2156, 6709, FSH 2109, 6709), EPA (40 CFR part 170), Occupational Safety and Health Administration (OSHA), and FIFRA safety standard guidelines.

3.8.3. Methodology for Analysis

The effects of invasive plants control relates back to the recreation experience and will be considered from two perspectives; the effectiveness of the control methods OR the impact of the control methods to recreationists who may be using the area during the control activities. The risks and consequences of proposed actions and the alternatives upon human health are analyzed separately, so this analysis will focus upon the effects of the alternative treatments upon the recreation resource and upon the recreationists who may be in or near the treatment activities. The qualitative nature of the analysis will compare the area of invasive plant control and the anticipated effectiveness of each alternative to other alternatives proposed in the analysis. The comparison relies generally on professional experience and observation of visitor behavior as well as observable changes to the natural appearing landscape as determined by other analysis.

Analysis Area

The analysis area includes the approximately 3,119,035 acres of the Salmon-Challis National Forest outside of the Frank Church River of No Return Wilderness Area, this area will be used as the analysis area for direct, indirect, and cumulative effects.

3.8.4. Affected Environment

3.8.4.1. Congressionally Designated Areas

Wilderness

The Frank Church River of No Return Wilderness (FC-RONR) is the largest Wilderness area in the lower 48 United States. On July 23, 1980, Congress passed the Central Idaho Wilderness Act, Public Law 96-312. This Act created the 2,361,767-acre River of No Return Wilderness. It is located in central Idaho occupying portions of the Boise, Bitterroot, Nez Perce, Payette, and Salmon-Challis National Forests. Also, portions of Custer, Idaho, Lemhi, and Valley Counties are contained within the wilderness. The lead Forest with respect to management of the Wilderness is the Salmon-Challis National Forest, and specifically the Middle Fork and North Fork Ranger Districts.

This project does not propose, nor does it analyze the treatment of invasive plants within the designated Wilderness, however its long shared border with the proposed project area does have a strong influence on the type of activities that are sought by recreationists even in those areas outside of wilderness.

Wild and Scenic Rivers

The Middle Fork of the Salmon River and segments of the main Salmon River have been designated as part of the National Wild and Scenic River System (national system). The presence of invasive plants along the river corridor can detract from the aesthetic and recreational opportunities, and impact the values for which the river has been designated.

The streams identified in Appendix Q were identified as eligible rivers and stream segments in a forest-wide assessment done in 2004. The attributes which contribute to the Outstandingly Remarkable Values (ORVs), water quality, and free flowing nature of the eligible stream segments are important to maintain until such time as suitability can be further determined.

Acres in national system and eligible river corridors that occur within designated wilderness would be subject to laws, standards and project design features pertaining to wilderness which are not being addressed as part of this analysis.

Middle Fork of the Salmon WSR

One of the original eight rivers in the nation designated as Wild and Scenic on October 2, 1968, the Middle Fork of the Salmon River originates 20 miles northwest of Stanley, Idaho, with the merging of Bear Valley and Marsh Creeks. The entire river, to its confluence with the Salmon River, is designated and is classified as wild with the exception of a one-mile segment near the Dagger Falls-Boundary Creek Road, which is classified as scenic. All except this short scenic segment is also within the Frank Church River of No Return Wilderness.

The Middle Fork is internationally recognized for its white water/wilderness floating. Known for its rugged scenic beauty, quiet isolation, crystal clear water and the challenge of its whitewater, it is floated by more than 10,000 people each summer. Class III - IV+ rapids offer boating excitement for both families and hard-core adventure types.

As noted above, with the exception of a single segment that is accessible at Boundary Creek via a non-wilderness corridor, this river lies entirely within the FC-RONR Wilderness. To date, no invasive plant populations have been mapped within the Boundary Creek/Dagger Falls cherry stem/bubble.

Main Salmon WSR

Known as "The River of No Return," the Salmon River is the longest free-flowing river (425 miles) within one state in the lower 48. It originates in the Sawtooth and Lemhi Valleys of central and eastern Idaho. Snows from the Sawtooth and Salmon River Mountains in the south, and the Clearwater and Bitterroot Mountains in the north, feed this river. The upper section passes through the Frank Church River of No Return Wilderness, while the lower section forms the southern boundary of the Gospel-Hump Wilderness. In recognition of the river's many outstanding values, including scenery, recreation, geology, fish, wildlife, water quality, botany, prehistory, history and cultural traditional use, Congress designated 46 miles of the river, from North Fork to Corn Creek, as a recreational river and 79 miles, from Corn Creek to Long Tom Bar, as a wild river.

Since 1976, a controlled permit system has been used to manage the boating in the wild segment of the river year around. Approximately 7,000 people go down the corridor via boat each summer through Class I to Class IV white water. The Salmon's abundant sandy beaches provide campsites to

boating groups throughout the summer and early fall. Floaters are not the only recreationists to enjoy the canyon; hikers, horse packers and jet boaters all share in the Salmon River experience. The historical use of jet boats was recognized by Congress as an integral part of the transportation system on the Salmon River; therefore, provisions were made to continue powerboat use.

The recreation segment of the Salmon River provides vehicle access to day-use boaters with several campgrounds, boat launches and picnic areas. While popular during the summer months for boating activities, the river corridor area is heavily used during spring steelhead season and very heavily used during the fall steelhead season when big game hunting seasons often overlap. Many of the popular fishing areas along this portion of the river are dispersed parking areas.

There are 12, 417 acres within the Salmon River Wild and Scenic River corridor outside of wilderness. Of these acres, there are 2,498 acres of mapped noxious weed infestations. Of those acres where noxious weeds occur, about 1% exhibit cover greater than 25%, a level at which the plants become visually dominant.

Eligible Wild and Scenic Rivers

The streams identified in Appendix Q were identified as eligible rivers and stream segments in a forest-wide assessment done in 2004, the Appendix displays the eligible stream segments on the Forest, the potential classification and the outstandingly remarkable values for which they are eligible. Prior to suitability determination or designation, the interim management corridor of eligible stream segments typically extends one-quarter mile from the centerline on each side.

There are 85,833 acres within the eligible stream segment corridors outside of designated Wilderness. These acres include 3,715 acres of mapped noxious weed infestations. Of those acres where noxious weeds occur, about 311 acres or 8% exhibit cover greater than 25%, a level at which the plants become visually dominant. Table 3-61 displays the stream segments with acres of noxious weed populations.

Table 3-61: Acres of Noxious Weed Infestations within Eligible Wild and Scenic Stream Segments

Stream Segment Name	# Acres in Percent Cover										Total
	<0.5	0.50	1	3	10	15	37	60	62	>63	
Bear Valley Creek	0.2	6.4		79.1	0.3	0.2	4.5			3.0	93.8
Camas Creek	0.3	181.2	0.5	314.4		10.8	1.2				508.5
East Fork Big Lost River	34.0					33.8					67.8
Hayden Creek	2.4	0.7		189.7	1.3	65.7				9.7	269.5
Kane Creek	10.5			35.1		0.3					45.9
Lake Creek				0.1							0.2
Lower Cedar Creek						0.2					0.2
Mill Creek	105.8										105.8
Muldoon Creek		31.2									31.2
Panther Creek	106.8	459.9	23.9	769.1		274.7	58.1		231.2	0.2	1,923.7
Pass Creek	11.7					0.2					11.9
Salmon River		2.4	0.8	9.9		3.4				0.2	16.7
Star Hope Creek		89.8									89.8
Star Hope Creek (W Fork Big Lost)		9.4				0.1					9.6
West Fork Yankee Fork											0.0
Wildhorse Creek								3.4			3.4
Yankee Fork	519.5	5.9		11.9							537.4
Totals	**791.1**	**787.0**	**25.3**	**1409.4**	**1.6**	**389.5**	**63.8**	**3.4**	**231.2**	**13.1**	**3,715.4**

3.8.4.2. Developed Recreation Sites

Mapped populations of invasive plants are found in 53 out of 96 developed recreation facilities on the Salmon-Challis National Forest (117 of 266 total acres). Invasive plants have been identified within the managed use area of these sites. Developed sites include areas such as campgrounds, trailheads, picnic areas, rental cabins, and boat launches. Developed recreation sites with sustained visitor interaction are particularly vulnerable to infestation due to transportation of seeds and viable plant parts to the sites by visitors, pets, vehicles, and stock. Many of the invasive plant sites associated with these recreation facilities are small (in acreage). They range in size from less than one acre to approximately 31 acres in size. Less than 1% of these sites exhibit cover greater than 25%, a level at which the plants become visually dominant in the site.

Visitor use in developed campgrounds and trailheads would be considered generally moderate during the bulk of the summer season. Use increases significantly during Memorial Day, July 4th and Labor Day weekends and would be considered relatively heavy. Use of developed sites typically drops off after Labor Day, except for those areas along the main-stem of the Salmon River below North Fork. These areas remain very active and heavily used through the fall months and into early winter due to steelhead fishing access opportunities. Light use of developed campgrounds does occur in conjunction with big game hunting season. Use of trail heads increases significantly during the fall season with big game hunters packing into wilderness and backcountry areas.

The following table (Table 3-62) shows developed recreation sites by ranger district, site name and acres of currently known noxious weed populations.

Table 3-62: Ranger District, Developed Recreation Site Name, and Acres of Noxious Weed Infestations

Ranger District	Recreation Site Name	Acres of Noxious Weeds
North Fork RD	Bear Creek Concentrated Use Area	0.30
	Cache Bar Boat Ramp	0.59
	Corn Creek CG/Boat Ramp	15.49
	Cove Creek Boating Site	1.10
	Deadwater Picnic Area	3.53
	Ebenezer Campground	2.31
	Fourth of July Concentrated Use Area	1.02
	Halfway Gulch Concentrated Use Area	0.72
	Horse Creek Hot Springs Campground	2.71
	Long Tom Picnic Area	0.60
	Newland Ranch Dump Station	0.44
	Newland Ranch Picnic Area	4.76
	Spring Creek Campground	31.27
	Twin Creek Picnic and Campground Complex	16.93
	Wagonhammer Picnic Area	0.59
Leadore RD	Bear Valley Campground/Trailhead, Lower	2.07
	Big Eightmile Campground/Trailhead	0.13
	Hawley Creek, Lower	0.73
	Hawley Creek, Upper	0.20
	Meadow Lake	0.10
	Reservoir Creek	0.07
	Timber Creek Reservoir, Lower	0.05
Challis/Yankee Fork RD	Big Bayhorse Day Use Area	0.10
	Big Creek Campground	0.54
	Blind Creek Campground	0.67
	Flat Rock Campground	0.71
	Flat Rock Extension Campground	0.20
	Greylock Concentrated Use Area	0.08
	Mill Creek Campground	0.18
	Morse Creek Campground	0.11
	Mosquito Flat Boating Site	0.17
	Mosquito Flat Picnic Area	0.32
	Mosquito Flat Campground	0.99
	Pole Flat Campground	0.27

Ranger District	Recreation Site Name	Acres of Noxious Weeds
	Pole Flat Picnic Area	0.10
	West Fork Morgan Creek	0.34
Salmon-Cobalt RD	Birdseye Creek Concentrated Use Area	0.10
	Cougar Point Campground	0.31
	Deep Creek Campground	2.68
	Lake Creek Concentrated Use Area	3.01
	Lost Spring Campground	0.02
	McDonald Flat Campground	3.47
	Peel Tree A-Frame Rental (site)	0.13
	Sawmill Concentrated Use Area	0.08
	Williams Creek Picnic Area	0.90
	Williams Lake Recreation Site Complex	1.92
	Yellowjacket GS Rental	0.05
Lost River RD	Earthquake Site	1.18
	Loristica Group Campground	4.39
	Park Creek Campground	0.47
	Pass Creek Narrows	0.27
	Star Hope Campground	0.11
	Timber Creek Campground	1.46

3.8.4.3. General Forest Area (GFA), Roads, and Trails

The general forest area is considered to be all areas not within a developed recreation site boundary, designated wilderness, or wild and scenic river corridor. They also include (overlap) those areas classified as Idaho Roadless (IRA) and unroaded areas not included in an IRA. Many of the invasive plant sites within the GFA occur near, or adjacent to roads and trails. Because the vast majority of users access the GFA by roads and trails, they tend to spend a disproportionate percentage of time within their proximity. The condition of the area immediately adjacent to roads and trails therefore has an outsized opportunity to affect perceptions, and therefore the quality of the recreation experience, as compared to more remote locations.

Roads and trails are considered to be areas with a high spread potential and therefore high priority for treatment. The Forest currently has 2,636 miles of inventoried roads in the project area. Of this amount 592 miles intersect existing weed populations (about 22% of the total). On over 32.8 miles of the 592 miles, the weed cover is 25% or greater and is becoming visually dominant. This is important given that recreational access to the Forest is the predominant use of the transportation system and driving for pleasure is a primary use of the Forest.

There are approximately 812 miles of non-motorized trails within the proposed project area and approximately 848 miles of designated motorized trail. Non-motorized trail uses include pack and saddle trails and hiking trails. Mountain bikes are permitted and sometimes used on trails outside wilderness. Motorized trails include those open to off-highway vehicles (OHVs) such as all-terrain vehicles (ATVs), motorcycle, and snowmobile trails. Neither of these networks of designated trail show extensive overlap with known invasive plant populations. As a whole, 63.3 (3.8%) miles intersect known populations and cover of weeds exceeds 25% along a total of 2.9 (0.2%) miles.

Under the existing Travel Management Plan, cross-country travel is no longer authorized. Snowmobile trails are typically on roads that are not plowed during winter and off trail use is

generally permitted when the ground is snow-covered. Most motorized trails on the Salmon-Challis are single track (18-24" wide) and open to motorcycles. Overall, motorized trail use on the Forest is currently low to moderate, but increasing steadily. The level of use increases forest-wide during big game hunting season.

Dispersed recreation sites are typically along roads and have developed due to repeated use by visitors. These site types are not usually inventoried or signed, nor do they have any other use controls associated with them. Overall incidence of summer dispersed camping is moderate, and is often associated with OHV riding and riparian areas that provide quality scenery and access to fishing or trails (both motorized and non-motorized). Dispersed camping during the hunting season would be considered high with camps occurring along many roads. Many hunter campsites are used by the same hunting group year after year.

Big game hunting is a major use of the GFA during the fall months. Dispersed camping, and OHV use for accessing remote hunting areas, scouting for game, and game retrieval (not permitted off trail) increase substantially during big game hunting season.

Approximately 42,683 acres of invasive plants have been identified across the Forest in GFAs, within the Project Area.

The following table (Table 3-63) summarizes acres of invasive plant treatments by recreation area type. The total acres occupied by invasive plants represent approximately 1.45% of the entire project area.

Table 3-63: Acres of Invasive Plants by Recreation Area Type

Recreation Area Type	Acres of Invasive Plants
WSR (designated and eligible)	6,213
Developed Recreation Sites	117
General Forest Area	42,683
Total	**49,013**

3.8.4.4. Idaho Roadless Areas

Idaho Roadless Areas (IRAs) are undeveloped areas typically exceeding 5,000 acres that met the minimum criteria for wilderness consideration under the Wilderness Act and that were inventoried during the Forest Service's Roadless Area Review and Evaluation (Rare II) process, subsequent assessments, Forest planning, and the Idaho Roadless Rule (36 CFR Part 294, Subpart C – Idaho Roadless Area Management, 2008).

Unroaded areas are defined as any area, without the presence of a classified road, of a size and configuration sufficient to protect the inherent characteristics associated with its roadless condition. Unroaded areas do not overlap roadless areas. For the purposes of this analysis, unroaded areas will not be specifically mapped or identified. They are analyzed with the GFAs, external to IRAs.

Within the proposed project area 58 Idaho Roadless Areas cover approximately 2,265,513 acres. The Idaho Roadless Areas comprise about 73% of the analysis area for this proposal. Of this total 7,761 acres contain known invasive plant infestations, representing 0.35% of the total IRA acres. The majority of these IRAs fall within the 'Backcountry/Restoration' management theme of the Idaho Roadless Rule (1,720,624 acres) although 'Wild Land Recreation', 'Primitive', 'General Forest',

and 'Special Areas' are also represented across the Forest. Appendix Q displays the breakout of management themes within each roadless area. Within the Special Areas theme, about 7,500 acres are within the Salmon River WSR management corridor and are covered in that discussion of the existing condition. Another 400 acres are within a "winter sports" designation, and do not have an inventoried population of invasive plants.

There are nine roadless characteristics (36 CFR 294.21) and six wilderness attributes used to evaluate IRAs and unroaded areas. The nine roadless characteristics and the six wilderness attributes are also identified and discussed in Appendix Q. An in-depth description of the condition of each of the roadless areas on the Forest and condition and character of each of the areas is further described in the FEIS for the Idaho Final Roadless Rule (2008) (a web-Linked reference to entire text is listed in reference section of this report).

Table 3-64: Idaho Roadless Areas and Mapped Noxious Weed Acres

IRA Name	Total Acres	Acres Noxious Weeds	Percent of IRA of Noxious Weeds
Agency	6,389	5.6	0.09
Allan Mountain[1]	46,478	51.9	0.11
Anderson Mountain	18,506	164.1	0.89
Blue Bunch	6,133	-	0.00
Blue Joint Mountain	48	-	0.00
Borah Peak[1]	130,463	3.6	0.00
Boulder-White Clouds	139,296	11.1	0.01
Camas Creek	103,968	165.1	0.16
Challis Creek	44,319	-	0.00
Cold Springs	8,929	0.1	0.00
Copper Basin	10,945	19.5	0.18
Deep Creek	7,148	3.2	0.04
Diamond Peak[1]	78,654	0.1	0.00
Duck Peak[1]	48,650	115.9	0.24
Goat Mountain	35,674	138.5	0.39
Goldbug Ridge	12,750.0	-	0.00
Greylock	11,825.00	-	0.00
Grouse Peak	8,953	1.9	0.02
Haystack Mtn	12,122	176.2	1.45
Hanson Lakes	13,534.00	-	0.00
Italian Peak	50,078	148.5	0.30
Jesse Creek	14,002	139.8	1.00
Jumpoff Mountain	14,449	3.7	0.03
Jureano	25,352	394.4	1.56
King Mountain	87,236	78.9	0.09
Lemhi Range[1]	308,532	225.1	0.07
Little Horse	7,629	-	0.00
Long Tom[2]	20,417	163.2	0.80
McEleny	3,541	32.0	0.90
Musgrove	8,182	-	0.00
Napias	9,292	-	0.00
Napoleon Ridge[2]	51,426	202.3	0.39
Oreana	7,575	0.7	0.01
Pahsimeroi Mountain	73,428	0.1	0.00
Perreau Creek	8,168	368.3	4.51
Phelan	13,025	-	0.00
Pioneer Mountains[1]	172,459	228.8	0.13
Porphyry	46,597	9.0	0.02
Railroad Ridge	7,913	11.9	0.15
Red Hill	15003	-	0.00
Red Mountain	4,897	-	0.00
Sal Mountain	13,974	58.9	0.42
Seafoam	31,066	-	0.00
Sheepeater[2]	35,424	662.0	1.87
South Deep Creek	12,647	0.2	0.00
South Panther	6,338	93.9	1.48
Spring Basin	5,232	4.8	0.09
Squaw Creek	99,636	79.0	0.08

IRA Name	Total Acres	Acres Noxious Weeds	Percent of IRA of Noxious Weeds
Taylor Mountain	63,438	49.4	0.08
Warm Creek	6,636	-	0.00
West Big Hole [1, 2]	84,405	2415.3	2.86
West Panther Creek	32,545	1226.3	3.77
White Knob	65,705	308.4	0.47
Wood Canyon	7,754	-	0.00
Total	**2,159,217**	**7,761.7**	**0.36**

[1]= Also contains RNA as "Special Management Area"
[2]=Also contains Main Salmon WSR as "Special Management Area"

3.8.4.5. Research Natural Areas

Special areas designated in forest plan amendments include Research Natural Areas (RNAs) which are permanently protected and maintained in natural conditions, for the purposes of conserving biological diversity, conducting non-manipulative research and monitoring, and fostering education. RNAs that are representative of common ecosystems in natural condition serve as baseline or reference areas. RNAs are managed to maintain the natural features for which they were established, and to maintain natural processes. Management prescriptions for maintaining the natural conditions in the RNA establishment reports require that overall noxious weed control will be as specific as possible against target organisms and induce minimal impact to other components of the area. Precautions will be taken to avoid the introduction of alien plants or animals into the RNA.

The majority of Research Natural Areas (26,621 acres) in the SCNF are located within Idaho Roadless Areas. Appendix Q displays information regarding the primary features and the Major Habitat types and Plant communities for which each RNA was established.

Currently, two RNAs have known invasive plant populations as shown on Table 3-65 below for a total inventory of 15.6 acres. Colson Creek RNA is NOT within the boundaries of an Idaho Roadless Area but is mostly within the management boundaries of the Scenic portion of the Main Salmon designated Wild and Scenic River Corridor and outside of designated wilderness. Iron Bog RNA is contained within the Pioneer Mountain IRA and has about 0.5 acres mapped with invasive plants.

Table 3-65: RNAs with populations of Invasive plants

RNA Name	RNA Acres	Invasive Acres	RNA Acres in IRA
Colson Creek	330	15.1	0
Iron Bog	434	0.5	434
Total	764	15.6	434

3.8.4.6. Visual Resources

The visual resource is an important overall component of the outdoor experience across the Salmon-Challis NF and on National Forests in general. In visitor use surveys, sightseeing is commonly listed as a focal point for many NF visitors. This demand is not limited to viewing alone, but is a significant component of the recreational experience when participating in a variety of recreation endeavors. The remoteness and undisturbed character of much of the proposed project area provide a very high quality experience over most of the Forest.

Invasive plants do have the potential to affect visual resources, primarily in the foreground of high use areas. This is part of the reason that areas adjacent to roads, trails and within WSRs can be very important to the overall recreational experience. Treatment activities also have the potential to affect the visual resources, again primarily in the foreground due to encounters with work crews, wilting plants or the use of dye to identify sprayed areas or plants. These effects are typically very short term in context (1 to 7 days).

3.8.5. Environmental Consequences

3.8.5.1. Alternative 1 – No Action

Direct and Indirect Effects

In general, with respect to designated and eligible WSR, Developed Recreation site operations and Idaho Roadless Areas there are no identified direct effects from the No Action alternative. Specifically, there would be no spray crews or any motorized/mechanical equipment out in the forest while visitors were using the forest. There may be some visitors who prefer a recreation experience where they can feel like they are out enjoying an uncrowded, quiet natural adventure. These visitors would have a short-term positive experience.

Over the longer term, the indirect effects of the No Action alternative, the existing populations of invasive plants can be expected to increase in density. Some species which have not yet been identified on the Forest will become established and increase in frequency and cover. Species that are already established can be expected to opportunistically expand their range and compete with native vegetation. Due to the propensity of invasive plants to benefit from human disturbance, the absence of treatment adjacent to developed and heavily used dispersed areas could lead to an accelerated rate of spread. The consequence of this and their ability to outcompete native vegetation would affect the timing of the impact upon the recreation experience. It is expected that those areas near developed and heavily used dispersed sites would colonize with invasive plants relatively quickly due to the effect of human disturbance.

The No Action would result in a negative effect to the visual resource. Since invasive plants are primarily visible in the foreground to the casual observer, the effect would be most notable within those areas where the majority of visitation occurs including those areas in, and around, developed and dispersed sites, within WSRs, and along roads and trails. With a rate of spread similar to that forecasted in Table 3-45, the total affected acres can be expected to double, within these corridors and high use areas within 7 to 8 years. In existing developed sites, this could result in some level of physical presence of invasive plants in essentially all locations within ten years. They are currently present in 53 of 96 developed sites and are present on 111 of 266 total acres. Along the Forest Road System, at the projected rate of spread, they would become established along an additional 760 miles of the existing 2,636 mile road system during the same timeframe (10 years), and would be present along more than 50% of the Forest's road system, at that point in time. In addition it is likely that the cover of existing populations would increase during this time which would make these sites more noticeable.

The effect of this alternative upon the Wild and Scenic River designated and eligible streams (outside of designated Wilderness) would be similar to the recreation experience overall. The Outstandingly Remarkable Values (ORVs) that they possess, and were recognized in the evaluation

process, may be affected due to the loss of native vegetation and natural plant communities and the consequences of this change to the scenic value as well as wildlife populations and distribution. If the vegetative conversions are complete enough to adversely affect water quality, this also has the potential to negatively impact the fisheries. The Main Salmon WSR, an area of 12,417 acres currently has 2,498 acres with some level of invasive plant infestation. This could potentially increase to over 6,400 acres (>50% of the designated area). Eligible streams and rivers are not as 'at risk' due to smaller invasive plant populations. Currently there are 85,833 total acres and 4.2% of this, or 3,609 acres, are known to have noxious weed populations. At an average rate of spread of 10% this would be expected to increase to 9,400 acres within the decade.

Access to key developed and dispersed sites may become more physically restricted due to the presence of invasive plants, such as thistle or spurge, that would discourage use of an area due to an invasive plant species creating a physical barrier, or being likely to cause an allergic reaction. Please see the Human Health Effects specialist report for other human health issues.

Effects to Idaho Roadless Areas are evaluated based upon the effects the alternative has upon the characteristics as described below. In the current condition some localized areas within the vast acreage of roadless areas have mapped populations of weeds. The highest percentage of invasive mapped acres in any of the IRA's is less than 5%, at that rate, the entire roadless area is most likely not impacted to the point where the roadless characteristics or the wilderness attributes have been compromised except at localized sites. While none of the identified alternatives would provide a permanent control option for invasive plants, implementation of Alternative 1 (No Action) would likely lead to more rapid colonization and population increases of these plants.

Because approximately 73% of the analysis area is within IRAs, the analysis in other sections of this report should disclose the effects to IRAs adequately as noted in the list of Roadless Characteristics below.

Roadless Characteristics

- High Quality or undisturbed soil, water, and air: (See Soil and Water Resources section).
- Sources of Public Drinking Water: (See Soil and Water Resources section).
- Diversity of plants and animal communities: (See Wildlife section for additional details).
- Habitat for threatened, endangered, proposed, candidate and sensitive species and for those species dependent upon large undisturbed areas of land: (See Wildlife and the Sensitive Plant section for additional details).
- Primitive, semi-primitive non-motorized and semi-primitive motorized classes of dispersed recreation: Selection of the No Action alternative would not likely inhibit these forms of recreation except in localized instances where invasive plants such as thistle become dense enough to physically make access difficult. Overall, this is expected to occur on relatively few acres. There is the potential for a direct, adverse effect to the quality of the dispersed recreation experience which would vary depending upon the emphasis that the user places upon any component of the overall experience. Factors which could potentially affect this experience include: changes in trail conditions caused by degradation in watershed conditions, visual consequences (described above), changes to wildlife populations and habits/territories, access to prime camps, impacts to fish populations and fishing opportunities (such as increased cloudy water days). The impacts of no action would be long-term as the population of invasive species increases

and would degrade the character of the roadless areas where they replaced native vegetation.

- Reference Landscapes: Within roadless areas, Research Natural Areas are considered a reference landscape mostly due to their unique plants/plant communities within relatively undisturbed landscapes. Weeds have the potential to establish and populate even undisturbed landscapes in the no action alternative. As weeds establish and populate these areas, the alterations render them less representative and less valuable to serve as a basis for comparison to more intensively managed landscapes. There are currently a total (recorded) of 7,761 acres upon which noxious weed populations occur (within IRAs). This would be expected to more than double to approximately 21,000 acres in ten years. These occupied acres would no longer serve as reference landscapes. Invasive plants would have the highest potential to increase into Research Natural Areas in this alternative.
- Natural appearing landscapes with high scenic quality: Overall this alternative would result in a negative impact to the scenic quality and natural appearance of the landscape as a whole. As invasive plants become more firmly established and increase in acreage and density, the visual consequences would become more obvious. The current total of 7,761 invasive plant occupied acres would be expected to expand to approximately 21,000 acres within ten years. The increase in 10 years would be still be slightly less than 1% (0.93%) and would be most apparent in the foreground and mid-ground to some observers. Although the percentage is small, it would be an evident long term alteration due to likely locations near places where visitors frequent within the vast roadless areas. Altered hydrology can also affect this characteristic over time.
- Traditional cultural properties and sacred sites: (See Cultural Resources section for additional information).
- Other locally identified unique characteristics: Areas specifically identified as 'special areas' within the roadless areas on the Salmon-Challis National Forest are primarily designated as Research Natural Areas (26,621 acres forest-wide). Invasive plants would have the highest potential to increase into Research Natural Areas in this alternative.

Wilderness Attributes

- Untrammeled: The No Action alterative would have little or no effect upon this characteristic with respect to the roadless areas.
- Natural: The No Action would affect the natural characteristics of the roadless areas due to the unintended consequences of not addressing control of invasive plants on a landscape basis. Currently approximately 0.35% of the existing IRAs are documented to support invasive species. Under this alternative this amount would be expected to increase to almost 1% within ten years. Although the percentage is small, it would be an evident long term alteration due to likely locations near places where visitors frequent within the vast roadless areas.
- Undeveloped: This alternative would have no effect upon this characteristic with respect the roadless areas.
- Outstanding opportunities for solitude or a primitive and unconfined type of recreation: Selection of Alternative 1 (No Action) would have a short term positive effect on the visitors who do not wish to encounter other people while they are on the forest. They would not be exposed to crews or equipment performing weed control activities. The

longer term impact of this alternative would be a less primitive landscape that was inundated with non-native species.

- Special Features: Special features are likely to be directly affected over the long term and in the short term by the selection of the No Action alternative because of the impacts to the native vegetation, and the ORV's of the designated and eligible Wild and Scenic River segments.
- Manageability/Boundaries: This alternative would have no effect with respect to manageability or boundary management with the roadless areas.

Other aspects of the recreation experience, primarily dependent upon the activity or quality that the recreation user is pursuing would also be affected. The discussion of visual and access problems addresses this to some extent, however the degree of invasive plant cover in an area can also have a collateral affect upon other components. The primary consideration within this context is the effect that noxious weed populations have upon wildlife and fish species, notably the potential for a reduction in population or relocation of existing populations. This can affect historic use patterns of wildlife and, consequently, the quality of experience for those visitors who seek some level of interaction (hunting, wildlife viewing, fishing, etc.). By not addressing treatment of areas in high use (recreation) sites, the long term effect with respect to these activities would be negative.

Cumulative Effects

In order to understand the contribution of past actions to the cumulative effects of this alternative, this analysis relies on current environmental conditions as a proxy for the impacts of past actions. This is because existing conditions reflect the aggregate impact of all prior human actions and natural events that have affected the environment and might contribute to cumulative effects. Future actions are those that are within the bounds of the existing Forest Plans. Current and Foreseeable activities in the SCNF are listed in Appendix H

All ground disturbing activities which are likely to occur on the Forest create the potential to establish invasive plant populations, or where they already exist, enhance the rate of spread. Although it is standard procedure to address these concerns during planning on a case by case basis (prevention), there is the concern that if these initial measures are ineffective, there would be no long term control option.

This alternative proposes no long term control strategy to address treatment of newly discovered populations or to arrest the spread of established populations. This could have a lasting impact upon the recreation resource. The fundamental effects of this would be the same as those addressed above under "Environmental Consequences: Alternative 1 – No Action: Direct and Indirect Effects". Differences may occur with respect to the rate at which the effects occur over time. This would be a function of the number and span of ground disturbing activities and the effectiveness of preventative control measures taken at the time of implementation.

3.8.5.2. Alternative 2– Current Action

Direct and Indirect Effects

Direct effects from the Current Action alternative activities can be expected to be visible during and immediately after treatments. Visible consequences may include instances where dye is readily

visible or where vegetation is wilted or dead. Where methods such as pulling are used, there may be some level of noticeable surface or soil disturbance. These visual impacts from these situations would be short term (generally 1-7 days), and generally minor in nature. Direct visual effects would occur in the designated and eligible WSR management corridors, developed recreation sites, along roads and trails in the general forest areas, and within the Idaho Roadless Areas.

During the period that physical treatment of invasive plants is occurring there may be some level of disturbance or visual distraction created by the presence of work crews. This may be disconcerting to some users dependent upon their opinions with respect to the chemicals being used.

The Main Salmon River WSR corridor outside of wilderness is currently a high priority area for treatment, and with design criteria in place to maintain the outstandingly remarkable values, the current actions have a positive direct and longer term, indirect effects on the amount, diversity and rate of spread of invasive plants. Colson Creek RNA is mostly within the WSR corridor and is part of the treatment for that corridor.

Effects to Idaho Roadless Areas are evaluated based upon the effects the alternative has upon the characteristics as described below. While none of the identified action alternatives would provide a permanent control option for invasive plants, implementation of Alternative 2 would display colonization and population increases of these plants at a more rapid rate than No Action but not as rapidly as the other action alternatives.

Because approximately 73% of the analysis area is within IRAs, the analysis in other sections of this report should disclose the effects to IRA's adequately as noted in the list of Roadless Characteristics below.

Roadless Characteristics

- High Quality or undisturbed soil, water, and air: (See Soil and Water Resources section).
- Sources of Public Drinking Water: (See Soil and Water Resources section).
- Diversity of plants and animal communities: (See Wildlife section and Sensitive Plant section for further details).
- Habitat for threatened, endangered, proposed, candidate and sensitive species and for those species dependent upon large undisturbed areas of land: (See Wildlife section).
- Primitive, semi-primitive non-motorized and semi-primitive motorized classes of dispersed recreation: Selection of the Current Action alternative would not likely to inhibit these forms of recreation except in localized instances where invasive plants such as thistle become dense enough to physically make access difficult. Overall, this is expected to occur on relatively few acres. There is the potential for a direct, adverse effect to the quality of the experience which would vary depending upon the 'weight' that the user places upon any component of the overall experience. Factors which could potentially affect this experience include: changes in trail conditions caused by degradation in watershed conditions, visual consequences (described above), changes to wildlife populations and habits/territories, access to prime camps, impacts to fish populations and fishing opportunities (such as increased cloudy water days).
- Reference Landscapes: Invasive plants have the potential to establish and populate even undisturbed landscapes. As this occurs within these areas, the alterations render them less representative and less valuable to serve as a basis (contracting) for

comparison to more intensively managed landscapes. There are currently at total (recorded) of 7761 acres upon which invasive plant populations occur (within IRAs). This would be expected to continue at the current rate. These occupied acres would no longer serve as reference landscapes.

- Natural appearing landscapes with high scenic quality: Overall this alternative would continue the status quo as impacts to the scenic quality and natural appearance of the landscape continue as a whole. As non-native invasive plants become more firmly established and increase in acreage and density, the visual consequences would become more obvious. This would be most apparent in the foreground and mid-ground but may also be evident in the background to some observers. Altered hydrology can also affect this characteristic over time.
- Traditional cultural properties and sacred sites: See Cultural Resources Section.
- Other locally identified unique characteristics: Areas specifically identified as 'special areas' within the roadless areas on the Salmon-Challis National Forest are primarily designated as Research Natural Areas (26,621 acres). Research Natural Areas would benefit directly and indirectly from the short term and long term effects of the current action alternative as part of the larger treatment of the landscape scale of roadless areas

Wilderness Attributes

- Untrammeled: The Current Action alterative would have little or no effect upon this characteristic with respect to the roadless areas.
- Natural: The Current Action would affect the natural characteristics of the roadless areas due to the unintended consequences of not addressing control of invasive plants on a landscape basis. Currently approximately 0.35% of the existing IRAs are documented to support non-native species. Under this alternative this amount would be expected to increase to almost 1% within ten years.
- Undeveloped: This alternative would have no effect upon this characteristic with respect the roadless areas.
- Outstanding opportunities for solitude or a primitive and unconfined type of recreation: Selection of Alternative 2 would have little effect upon the opportunities for solitude and of a primitive/unconfined type of experience.
- Special Features: Special features are unlikely to be directly affected by the selection of the Current Action alternative.
- Manageability/Boundaries: This alternative would have no effect with respect to manageability or boundary management with the roadless areas.

Cumulative Effects

The effects to the recreation resource associated with invasive plant treatments under Alternative 2 in conjunction with any reasonably foreseeable future activities are short term. It is unlikely that continued treatment activities will occur over a wide range of recreation sites simultaneously so although some displacement of users may occasionally cause inconvenience, this is not a significant concern.

It is anticipated that all future ground disturbing activities will be developed with project specific preventative control measures. This should allow the Forest to minimize the impact of future

management actions on the introduction or spread of invasive weeds. This would minimize the effect of future activities on the recreation resource including affects to designated and eligible WSR management corridors, developed recreation sites, roads and trails within the general forest areas, the characteristics and components of the IRAs and the overall visual quality objectives for the project area. Current and Foreseeable activities on the SCNF are listed in Appendix H.

3.8.5.3. Alternative 3 - Proposed Action

Direct and Indirect Effects

Direct effects from the activities can be expected to be visible during and immediately after treatments. Visible consequences may include instances where dye is readily visible or where vegetation is wilted or dead. Where methods such as pulling are used, there may be some level of noticeable surface or soil disturbance. Direct visual effects would occur in the designated and eligible WSR management corridors, developed recreation sites, along roads and trails in the general forest areas, and within the Idaho Roadless areas. These visual impacts from these situations would be short term (generally 1-7 days), and generally minor in nature.

During the period that physical treatment of invasive plants is occurring there may be some level of disturbance or visual distraction created by the presence of work crews. This may be disconcerting to some users dependent upon their opinions with respect to the chemicals being used.

Aerial spray operations, and even some ground based application may result in limited restriction of access to the General Forest Area, or identified recreation sites, in the immediate vicinity of operations. Immediately prior to, during, and immediately after spray operations the affected area would be closed to prevent public access and reduce the possibility of exposure.

The indirect effects of the proposed action with all appropriate design criteria in place would result in the existing populations of invasive plants to increase in cover and to spread over time, but at a slower rate than under Alternative 1 and Alternative 2. Each of the various control measures would have the indirect effect of slowing the rate of spread overall and the effect may be particularly dramatic in the vicinity of developed and heavily used dispersed recreation sites due to the accessibility and consistency of treatment in these locations. Human disturbance is one cause for the spread of invasive plants. There would be a positive, long-term effect in reducing the spread of invasive plants by treating developed and heavily used dispersed recreation sites. There would be an indirect and positive effect upon the recreation experience with respect to visual resources and physical access.

By slowing or, in some cases, halting the spread of individual invasive plants and invasive plant populations, the Proposed Action alternative would effectively preserve the visual characteristics of the high use corridors, when compared to Alternative1 (No Action) and the aerial application component of this alternative may provide an option to treat at more of a landscape scale, and provide a means of treating remote and difficult to access locations such as the Idaho Roadless Areas.

With the proposed design criteria in place, the effect of this alternative upon the Wild and Scenic River designated and eligible stream management corridors (outside of designated Wilderness) would be largely reflective of the anticipated rate of spread of existing populations and the likelihood that new populations would establish and spread. This includes the known infestations

within the Colson Creek RNA. The Proposed Action is an appropriate activity in and adjacent to WSR corridors, including classified 'Wild' segments, since the intent of the activity is to protect or restore the natural environment. The Outstandingly Remarkable Values (ORVs) that these streams possess would likely continue to be affected, however the rate of change, and the degree to which this change is apparent, should be substantially reduced (when compared to Alternative 1 (No Action) in most areas due to prescribed treatment activities. This includes the use of Early Detection and Rapid Response (EDRR) to address newly discovered and treatable populations.

Effects to Idaho Roadless Areas are evaluated based upon the effects the alternative has upon the characteristics as described below. While none of the identified alternatives would provide a permanent control option for invasive plants, implementation of Alternative 3 would likely lead to more effective control than each of the other action alternatives and a greatly reduced rate of spread as compared to Alternative 1. It would also lead to a reduced incidence of newly established populations (EDRR).

Because approximately 73% of the analysis area is within IRAs, the analysis in other sections of this report should disclose the effects to IRA's adequately as noted in the list of Roadless Characteristics below.

Roadless Characteristics

- High Quality or undisturbed soil, water, and air: (See Soil and Water Resources section).
- Sources of Public Drinking Water: (See Soil and Water Resources section)
- Diversity of plants and animal communities: (See Sensitive Plant and Wildlife sections for additional information).
- Habitat for threatened, endangered, proposed, candidate and sensitive species and for those species dependent upon large undisturbed areas of land: (See Wildlife section for additional information).
- Primitive, semi-primitive non-motorized and semi-primitive motorized classes of dispersed recreation: There may also be closures within planned treatment sites at times immediately surrounding aerial spray operations to prevent exposure to recreational users. These would be infrequent and temporary. The quality of the recreation experience would remain similar to existing conditions to the extent that the treatment methods are effective.
- Reference Landscapes: Of the analyzed alternatives, The Proposed Action would most effectively address the capacity of the roadless areas to serve as reference landscapes. The use of early detection and rapid response coupled with traditional control methods and aerial applications provide the most flexibility to target individual situations with the most effective treatment option.
- Natural appearing landscapes with high scenic quality: The Proposed Action would result in maintenance of the scenic quality and natural appearance of the landscape as a whole, to the extent possible given current methodology and cost considerations. The wide variety of treatment options, including aerial application would result in the most effective treatment alternative considered.
- Traditional cultural properties and sacred sites: See Cultural Resources section for additional information about these resources.

- Other locally identified unique characteristics: Areas specifically identified as 'special areas' (28,500 acres) within the roadless areas on the Salmon-Challis National Forest are primarily designated as Research Natural Areas (26,621 acres).

Wilderness Attributes

- Untrammeled: Alternative 3 would have little or no effect upon this characteristic with respect to the roadless areas.
- Natural: Alternative 3 would best preserve the natural characteristics of the roadless areas. The variety of treatment methods available, including aerial application, would allow some measure of control of existing populations with respect to density and spread, and can eliminate new infestations if identified early enough (EDRR).
- Undeveloped: Alternative 3 would have no effect upon this characteristic with respect the roadless areas.
- Outstanding opportunities for solitude or a primitive and unconfined type of recreation: Selection of Alternative III would have little effect upon the opportunities for solitude and of a primitive/unconfined type of experience. The exceptions to this would occur during the short-term when aerial or land based activities are physically taking place, which would affect the opportunity for solitude The unconfined type of experience could be affected if an area were to be closed for treatment during a planned aerial application. This effect would be short term (1-7 days) and temporary.
- Special Features: Special features would not be directly affected by the selection of Alternative 3.
- Manageability/Boundaries: This alternative would have no effect with respect to manageability or boundary management with the roadless areas.

Other aspects of the recreation experience, primarily dependent upon the activity or quality that the recreation user is pursuing would also be preserved, at least within the foreseeable future. The discussion of visual and access problems addresses this to some extent, however the degree of invasive plant cover in an area can also have a collateral affect upon other components. The primary consideration within this context is the effect that noxious weed populations have upon wildlife and fish species, notably the potential for a reduction in population or relocation of existing populations. This can affect historic use patterns of wildlife and, consequently, the quality of experience for those visitors who seek some level of interaction (hunting, wildlife viewing, fishing). By continuing to address invasive plant infestations in, and around, sites offering high levels of recreation access, the negative effect on these activities would be effectively delayed or, in some cases, alleviated.

3.8.5.4. Alternative 4 - No Aerial Herbicide Application

Direct and Indirect Effects

Direct effects from the activities can be expected to be visible during and immediately after treatments. Visible consequences may include instances where dye is readily visible or where vegetation is wilted or dead. Where methods such as pulling are utilized, there may be some level of noticeable surface or soil disturbance. Direct visual effects would occur in the designated and eligible WSR management corridors, developed recreation sites, along roads and trails in the general forest areas, and within the Idaho Roadless areas. These visual impacts from these situations would

be short term (generally 1-7 days), and generally minor in nature During the period that physical treatment of weeds is occurring there may be some level of disturbance or visual distraction created by the presence of work crews. Because the areas around developed recreation sites would not be affected by aerial application, the direct effect of this alternative is similar to the Proposed Action alternative. This may be disconcerting to some users dependent upon their opinions with respect to the chemicals being used. Trail and area closures in the interest of public safety may cause some visitors to be inconvenienced or to choose to use another location on the Forest.

Overall, the expected indirect effects of the No Aerial Herbicide Application alternative indicate the existing populations of invasive plants would increase in cover and to spread at a slower rate than under Alternative 1 (No Action) or Alternative 2 (Current Action). Control measures would have the effect of slowing the rate of spread overall and the effect may be particularly dramatic in the vicinity of developed, and heavily used dispersed recreation sites due to the accessibility and consistency of treatment in these locations. Human disturbance is one cause for the spread of invasive plants. There would be a positive long term effect in reducing the spread of invasive plants by treating developed, and heavily used dispersed recreation sites. There would be an indirect and positive effect to visual resources and physical access. The consequence of this would delay the timing of the impact upon the recreation experience, primarily with respect to visual and physical access concerns. Because aerial application is not an option under this alternative it would not be as effective as Alternative3 (Proposed Action) in addressing infestations that are not as easily accessed by conventional means such as more remote areas within General Forest Areas, or within Idaho Roadless Areas.

By slowing or, in some cases, halting the spread of individual invasive plants and invasive plant populations, the alternative would effectively enhance, over time, the visual characteristics of the high use corridors, as compared to Alternative 1 (No Action). In those areas outside of the high use corridors, such as more remote general forest areas or the larger Idaho Roadless Areas, this alternative would likely be less effective at preserving these characteristics than Alternative 3 (Proposed Action).

This alternative is an appropriate activity in and adjacent to WSR corridors, including classified 'Wild' segments, since the intent of the activity is to protect or restore the natural environment.

Implementation of Alternative 3 (Proposed Action) would likely lead to more effective control than Alternative 4 (No Aerial Herbicide Application alternative), especially in remote locations and a greatly reduced rate of spread when compared to Alternative 1. Alternative 4 is slightly more effective than Alternative 2 (Current), since it still includes aquatic treatment options. It would also lead to a reduced incidence of newly established populations (EDRR).

Because approximately 73% of the analysis area is within IRAs, the analysis in other sections of this report should disclose the effects to IRAs adequately as noted in the list of Roadless Characteristics below.

Roadless Characteristics

- High Quality or undisturbed soil, water, and air: (See Soil and Water Resources section).
- Sources of Public Drinking Water: (See Soil and Water Resources section)

- Diversity of plants and animal communities: (See Sensitive Plant and Wildlife sections for additional information).
- Habitat for threatened, endangered, proposed, candidate and sensitive species and for those species dependent upon large undisturbed areas of land: (See Wildlife section for additional information).
- Primitive, semi-primitive non-motorized and semi-primitive motorized classes of dispersed recreation: Selection of the Alternative 4 would not be likely to inhibit these forms of recreation except in localized instances where invasive plants such as thistle become dense enough to physically make access difficult, which could potentially occur even with treatment options. The quality of the recreation experience would remain similar to existing conditions to the extent that the treatment methods are effective and in those locations where they can be economically implemented.
- Reference Landscapes: Alternative 4 (No Aerial Herbicide Application) would be more effective at addressing the capacity of the roadless areas to serve as reference landscapes than the No Action or the Current Action alternatives. The use of early detection and rapid response coupled with traditional control methods provide effective treatment option where easy access exists. Those areas that are more remote or would be more economically treated with aerial applications (wide area) would continue to degrade at a similar rate as in the No Action alternative.
- Natural appearing landscapes with high scenic quality: Alternative 4 would result in maintenance of the scenic quality and natural appearance of the landscape as a whole, to the extent possible given current methodology and cost considerations, within treatable locations.
- Traditional cultural properties and sacred sites: See Cultural Resources section for additional information about these resources.
- Other locally identified unique characteristics: Areas specifically identified as 'special areas' (28,500 acres) within the roadless areas on the Salmon-Challis National Forest are primarily designated as Research Natural Areas (26,621 acres). Effects to these RNAs are the same as Alternative 3 because design criteria would not allow aerial application in either alternative within RNAs.

Wilderness Attributes

- Untrammeled: Alternative 4 would have little or no effect upon this characteristic with respect to the roadless areas.
- Natural: Alternative 4 would slow the decline of natural characteristics of the roadless areas. The variety of treatment methods available would allow some measure of control of existing populations with respect to density and spread, and can eliminate new infestations if identified early enough (EDRR).
- Undeveloped: Alternative 4 would have no effect upon this characteristic with respect the roadless areas.
- Outstanding opportunities for solitude or a primitive and unconfined type of recreation: Selection of Alternative 4 would have little effect upon the opportunities for solitude and of a primitive/unconfined type of experience. The exceptions to this would occur when control activities are physically taking place, which would affect the opportunity for solitude. This effect would be short term (1-7 days) and temporary and less than those of Alternative 3 which may include the aerial Application in remote settings.

- Special Features: Special features would not be directly affected by the selection of Alternative 4.
- Manageability/Boundaries: This alternative would have no effect with respect to manageability or boundary management within the roadless areas.

3.8.5.5. Alternative 5 - No Aquatic Herbicide Application

Direct and Indirect Effects

Direct effects from the activities can be expected to be visible during and immediately after treatments. Visible consequences may include instances where dye is readily visible or where vegetation is wilted or dead. Where methods such as pulling are utilized, there may be some level of noticeable surface or soil disturbance. Direct visual effects would occur in the designated and eligible WSR management corridors, developed recreation sites, along roads and trails in the general forest areas, and within the Idaho Roadless areas. These visual impacts from these situations would be short term (generally 1-7 days), and generally minor in nature.

During the period that physical treatment of invasive plants is occurring there may be some level of disturbance or visual distraction created by the presence of work crews. This may be disconcerting to some users dependent upon their opinions with respect to the chemicals being used.

High risk areas near boat ramps would not be treated, except by current means such as hand removal, direct effects of this alternative on developed recreation sites are similar to that of Alternative 2 - Current Action.

Overall, the expected indirect effects of the No Aquatic Herbicide Application alternative on the existing populations of invasive plants found in and near high use water-based recreation sites and in the river and stream corridors can be expected to increase in cover and to spread over time, but at a slower rate than under Alternative 1 or Alternative 2. Control measures would have the effect of slowing the rate of spread overall and the effect may be particularly dramatic in the vicinity of developed, and heavily used dispersed recreation sites due to the accessibility and consistency of treatment in these locations.

Human disturbance is one cause for the spread of invasive plants. There would be a positive long term effect in reducing the spread of invasive plants by treating developed, and heavily used dispersed recreation sites. There would be an indirect and positive effect to visual resources and physical access. Because aquatic application is not an option under this alternative it would not be as effective as Alternative 3 in addressing high risk areas near water such as boat ramps, infestations close to water-based recreation sites and trails. The potential impact to recreation, visual resources, Wild and Scenic Rivers and IRA roadless characteristics because of the inability to treat noxious weeds in an aquatic setting may be similar to the current action.

By slowing or, in some cases, halting the spread of individual invasive plants and invasive plant populations, the alternative would effectively preserve the visual characteristics of the high use corridors, when compared to Alternative 1. In those areas outside of the high use corridors, such as more remote areas of General Forest Areas or Idaho Roadless Areas, this alternative would likely be less effective at preserving these characteristics than Alternative 3. The level of access would also remain high.

With the proposed design criteria in place, the effect of this alternative upon the Wild and Scenic River designated and eligible stream management corridors (outside of designated Wilderness) would be largely reflective of the anticipated rate of spread of existing populations and the likelihood that new populations would establish and spread. This includes the known infestations within the Colson Creek RNA. This alternative reduces the range of treatments available for use in and adjacent to WSR management corridors, including classified 'Wild' segments. The Outstandingly Remarkable Values (ORVs) that these streams possess would likely continue to be affected (by invasive plants), however the rate of change, and the degree to which this change is apparent, should be substantially reduced (compared to Alt 1) in most areas due to prescribed treatment activities. This includes the use of Early Detection and Rapid Response (EDRR) to address newly discovered and treatable populations.

Effects to Idaho Roadless Areas are evaluated based upon the effects the alternative has upon the characteristics as described below. While none of the identified alternatives would provide a permanent control option for invasive plants, implementation of Alternative 5 will likely lead to less effective control than Alternative 3 (especially in locations where aquatic species invasion is eminent). Alternative 5 would have a greatly reduced rate of spread when compared to Alternative1. It would also lead to a reduced incidence of newly established populations (EDRR).

Because approximately 73% of the analysis area is within IRAs, the analysis in other sections of this report should disclose the effects to IRA's adequately as noted in the list of Roadless Characteristics below.

Roadless Characteristics

- High Quality or undisturbed soil, water, and air: (See Soil and Water Resources section).
- Sources of Public Drinking Water: (See Soil and Water Resources section)
- Diversity of plants and animal communities: (See Sensitive Plant and Wildlife sections for additional information).
- Habitat for threatened, endangered, proposed, candidate and sensitive species and for those species dependent upon large undisturbed areas of land: (See Wildlife section for additional information).
- Primitive, semi-primitive non-motorized and semi-primitive motorized classes of dispersed recreation: Selection of the Alternative 5 would not be likely to inhibit these forms of recreation except in localized instances where invasive plants such as thistle become dense enough to physically make access difficult, which could potentially occur even with treatment options. The quality of the recreation experience would remain similar to existing conditions to the extent that the treatment methods are effective and in those locations where they can be economically implemented.
- Reference Landscapes: Alternative 5 would be more effective at addressing the capacity of the roadless areas to serve as reference landscapes than the No Action alternative. The use of early detection and rapid response coupled with traditional control methods provide effective treatment option where easy access exists. Those areas or types of invasive plants that would be more economically treated with aquatic applications (wide area) would continue to degrade at a similar rate as in the No Action alternative.
- Natural appearing landscapes with high scenic quality: Alternative 5 would result in maintenance of the scenic quality and natural appearance of the landscape as a whole,

to the extent possible given current methodology and cost considerations, within treatable locations.

- Traditional cultural properties and sacred sites: See Cultural Resources section.
- Other locally identified unique characteristics: Areas specifically identified as 'special areas' (28,500 acres) within the roadless areas on the Salmon-Challis National Forest are primarily designated as Research Natural Areas (26,621 acres).

Wilderness Attributes

- Untrammeled: Alternative 5 would have little or no effect upon this characteristic with respect to the roadless areas.
- Natural: Alternative5 would slow the decline of natural characteristics of the roadless areas. The variety of treatment methods available would allow some measure of control of existing populations with respect to density and spread, and can eliminate new infestations if identified early enough (EDRR).
- Undeveloped: Alternative 5 would have no effect upon this characteristic with respect the roadless areas.
- Outstanding opportunities for solitude or a primitive and unconfined type of recreation: Selection of Alternative5 would have little effect upon the opportunities for solitude and of a primitive/unconfined type of experience. The exceptions to this would occur when control activities are physically taking place, which would affect the opportunity for solitude. This effect would be short term (1-7 days) and temporary.
- Special Features: Special features would not be directly affected by the selection of Alternative 5.
- Manageability/Boundaries: This alternative would have no effect with respect to manageability or boundary management within the roadless areas.

Other aspects of the recreation experience, primarily dependent upon the activity or quality that the recreation user is pursuing, will also be preserved, at least within the foreseeable future. The discussion of visual and access problems addresses this to some extent, however the degree of invasive plant cover in an area can also have a collateral affect upon other components. The primary consideration within this context is the effect that invasive plant populations have upon wildlife and fish species, notably the potential for a reduction in population or relocation of existing populations. This can affect historic use patterns of wildlife and, consequently, the quality of experience for those visitors who seek some level of interaction (hunting, wildlife viewing, fishing). By continuing to address weed infestations in, and around, sites offering high levels of recreation access, the negative effect on these activities will be effectively delayed or, in some cases, mitigated.

3.8.6. Cumulative Effects For Alternatives 3, 4 and 5

The effects to the recreation resource associated with invasive plant treatments under alternatives 3, 4, and 5 in conjunction with any reasonably foreseeable future activities are short term. It is unlikely that treatment activities would occur over a wide range of recreation sites simultaneously so although some displacement of users may occasionally cause inconvenience, this is not a significant concern.

It is anticipated that all future ground disturbing activities would be developed with project specific preventative control measures. This, combined with EDRR and ground and aerial based treatment

options, should allow the Forest to minimize the impact of future management actions on the introduction or spread of invasive plants. This would minimize the effect of future activities on the recreation resource including effects to designated and eligible WSR management corridors, developed recreation sites, roads and trails within the general forest areas, the characteristics and components of the IRAs and the overall visual quality objectives for the project area. Current and Foreseeable activities in the SCNF are listed in Appendix H.

3.9. Economics

3.9.1. Introduction

This section analyzes the cost/benefit of various treatment methods and the potential economic effect resulting from implementation of the alternatives both from the impacts of invasive plants and the impacts of invasive plant control.

3.9.2. Measurement Indicators

- Average cost of treatment method per acre

3.9.3. Compliance with Forest Plan and Other Relevant Direction

The Idaho Invasive plants Plan 2012-2016 identifies the goals of the strategy are to:

1. Prevent the introduction of new invasive plants to Idaho
2. Limit the spread of introduced invasive plants in Idaho
3. Abate ecological and economic impacts that result from invasive plants populations in Idaho

The strategic plan outlines a framework how efforts can cost-effectively prevent and manage invasive plants in the State of Idaho (ISDA 2012).

Both the Challis NF and Salmon NF LRMPs are silent in regards to standards and guidelines for economics. The action alternatives do comply with the Idaho Invasive plants Plan; the No Action alternative does not comply with that plan.

3.9.4. Methodology for Analysis

Analysis was done utilizing relevant research, data, and other information applicable to economic impacts and invasive plant treatments.

Analysis Area

The analysis area for direct, indirect and cumulative effects are addressed at a three county-wide level.

3.9.5. Affected Environment

3.9.5.1. Economic Impact of Invasive Plants

It is well documented that invasive plant species have substantial negative economic impacts. The estimate of the economic impact weeds had in the US based on control costs and production losses is $30.6 billion (in 2008 dollars). Aquatic weeds cost $122 million in losses, damages, and control costs (Cusak et al. 2009). In Idaho, noxious weeds are estimated to have a direct cost of $300 million annually (ISDA 2014).

Comprehensive regional economic data is lacking or dated for invasive plants. A study done in the mid-1990s estimated that knapweeds had direct and indirect impacts on Montana's economy of $42 million annually. Another study done in the mid-1990s estimated that leafy spurge infestations had direct and secondary economic impacts in Montana, Wyoming and the Dakotas of $130 million and represented a loss of 1,433 jobs (Duncan et al. 2004).

Updating the numbers in the mid-1990s study of the economic impacts of knapweeds in Montana, it was found that each knapweed infested acres on grazing land has a $14.67 per acre negative impact and on wildlands it has a $5.45 per acre negative impact (2009 dollars) (Kerkvliet 2010).

Examples of how invasive plants can pose an economic burden include reduced grazing potential, alteration of fire regimes, reverse riparian recovery efforts, fewer recreational opportunities, loss of agricultural productivity, and reduced property values (PNWER Invasive Species Working Group 2012).

A study in Nevada found that invasive plant species cause the state to lose $6 to $12 million dollars annually on wildlife-related recreation and predicted future losses (approximately 2010) ranged from $30 to $40 million. At the time of the study, Nevada ranked 47th in the nation for wildlife-related recreation (Eiswerth et al. 2005).

The 2011 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation found that Idaho ranked 8th highest in the nation for people participating in wildlife-related recreation (hunting, fishing, and wildlife watching). Wildlife related recreation expenditures in the state totaled $1.6 billion dollars in 2011 (USDI FWS and USDC CB 2011).

The 2012 Census Bureau Data identified the industries in which the percent of the employed population work (USDC CB 2012). The percentage of the people employed in industries that could have direct impacts from invasive plants (agriculture, fishing and hunting) is much higher (2.5 to 5 times) than the state as a whole (

Table 3-66). There are 104 outfitting businesses licensed by Idaho Outfitter and Guide Licensing Board to operate on the Salmon-Challis National Forest. The businesses include activities such as float and power boating, trail riding/pack trips, backpacking, fishing, big game hunting, upland game bird hunting, photography, and bicycling (IOGLB 2014). There are 149 livestock grazing permittees in the SCNF- effects of the alternatives are addressed in the Range analysis.

Table 3-66: Percentage of Employed Persons by Selected Industry

Industry	Idaho	Custer County	Butte County	Lemhi County
Agriculture, forestry, fishing and hunting, mining	5.4%	26.8%	13.7%	15.8%

The economic impact of most invasive plants is poorly documented due to a lack of quantitative data on ecosystem impacts and challenges assessing nonmarket costs to society and the environment (Duncan et al. 2004). Most studies focus on the loss of provisioning services and the resulting direct use (direct value, indirect value, option value) economic impacts from invasive plants. Few studies take into account the non-use impacts of invasive plants (option values, bequest value, existence values) (Cusak et al. 2009).

Assessments tend to include control and management costs, but do not address ecosystem services. The alterations of ecosystem services by invasive plants are not fully assessed due to the subjective nature and difficulty assigning value. Impacts to agriculture, industry, and human health are substantial, well documented, and generally negative. This includes food production, water delivery and purification, pollination, natural pest control, disease regulation, soil fertility, and nutrient and water cycling. Cultural services (aesthetic values, recreation, tourism) are being substantially, if not quantifiably, impacted by invasive species. Decreased biodiversity and species extinctions linked to invasive species threaten the delivery and quality of ecosystem services (Charles and Dukes 2007).

3.9.5.2. Cost of Treatment

Virtually all studies that look at the cost of invasive species control come to the same basic conclusion. Prevention and early detection are the most cost effective means of addressing invasive species and costs increase, often nearly exponentially, as infestation size and density increase. A proactive approach which is focused on a systematic prevention and early control of infestations would provide solid economic returns (USDA SWCA 2012). As an acknowledgment of the cost-effectiveness of this, prevention activities account for approximately half of U.S. federal expenditures for invasive species (Kerkvliet 2010). Doing nothing can be the most expensive decision because of the ensuing expansion of the invasive plant and the subsequent impact it may have on the native plant and animal communities (Beck 2012).

After prevention, early detection is the most cost-effective methods of controlling and preventing the spread of invasive species. The cost-to-benefit ratio of early detection, control, and eradication was determined to be 34:1 (savings of $34 for every $1 spent) (Cusak et al. 2009). In the case of leafy spurge, positive returns generally occurred when herbicide was applied to small (<0.5 acres) infestations (Bangsund et al. 1996).

In well-established infestations, it may not be economically optimal to attempt to eradicate the species; rather strategies that control spread may be optimal (Eiswerth and Van Kooten 2002). Again, in the case of leafy spurge, under some rangeland conditions, long-term herbicide control (20 years) of leafy spurge can produce positive returns, which vary based upon factors such as infestation size, spread rate, land productivity, and frequency and rate of herbicide applications. The larger the infestation becomes, the less effective the control. In most situations, long-term control of leafy spurge using herbicides is a viable economic alternative to no treatment (Bangsund et al. 1996). Leafy spurge infestations are a long-term management program. Existing infestations

need to be contained, while monitoring adjacent lands to keep it from spreading and designing long-term programs to gradually eliminate dense infestations (USDA SWCA 2012).

A survey of land managers found that budgets to treat weeds fell short (by over half) to fulfill agencies' missions (Kerkvliet 2010). Labor is the most expensive part of a weed management program. Limited budgets must be stretched to be as effective as possible. Because of known performance and decreased labor, herbicides are often the most cost effective means to control weed populations so restoration can occur (Beck 2012).

The cost of manual control exceeds the cost of using a herbicide by 800 to 1500%. In one experiment hand pulling and mowing were ineffective at controlling rosettes or bolted diffuse knapweed; herbicide and herbicide and mowing were 8 to 84% effective (rosette) and 89 to 100% (bolted) one year after treatment. In a second experiment, hand pulling controlled half of knapweed plants; herbicide controlled 79-100%. Mowing and herbicide was similar to herbicide alone. In both experiments, herbicide treatment cost 1% of the cost of hand pulling and controlled twice (or more) the knapweed (Beck 2012).

It is virtually impossible to estimate the future invasive plant control budget for the SCNF because fiscal year allocations can be variable. The base program dollars have remained fairly constant over past few fiscal years, but post-wildfire treatment dollars and Resource Advisory Committee (RAC) funds have been far more variable. However, the general trend is that overall budgets are decreasing. Table 3-67 identifies the monies allocated to the SCNF invasive plants program over the last 6 years.

Table 3-67: SCNF Invasive plants Program Budget 2008-2013

Funding Source	2008	2009	2010	2011	2012	2013
Base funds- $ allocated by Congress	223,981	212,540	214,398	209,972	274,024	204,274
Total $ including other funds such as post-fire restoration	490,232	553,133	449,869	424,465	497,243	900,460

Table 3-68 shows the estimated cost of treating an acre based upon different treatment methods. This cost is based upon average expenditures and market values and can be variable.

Table 3-68: Cost Per Acre by Treatment Method

Treatment Method	Personnel and Equipment Costs	Herbicide	Estimated Cost Per Acre
Biocontrol (personnel and agent- high estimate)	$130	$30 (cost of bio-agent)	$165
Manual (hand-pulling)	$3,572[1]	N/A	$3,572
Backpack Herbicide Spraying	$175	$24[2]	$199
UTV/Stock Spraying	$90	$24	$114
Vehicle Broadcast Spraying	$45	$24	$69
Aerial Spraying	$35	$24	$59

[1]The cost of hand pulling is based on the following information: labor = $12/hour; time required to hand pull an area of 1,200 ft^2 = 4.1 hours; ($49.20/1,200 ft^2) × (43,560 ft^2/acre) = $3,572/acre (Beck 2012)
[2] Herbicides cost approximately $5 to $19 per acre; $24 represents the average cost of a tank mixture.

3.9.6. Environmental Consequences

3.9.6.3. Alternative 1 - No Action

Direct and Indirect Effects

No early detection/ rapid response strategy combined with the lack of any control methods would allow for the invasion of new non-native invasive plants and the relatively unchecked spread of existing populations, which in turn could impact other ecosystem processes such as wildlife habitat quality and fire return intervals. No restoration activities would occur, so there would be no opportunities to improve the resiliency of native plant communities. The wildlife-related recreation and agricultural industries are among the primary revenue generating businesses in the three-county analysis area. Impacts to habitat quality, water quality, and scenery would be expected to have a negative economic impact. The No Action alternative does not comply with the goals of the Idaho Invasive Species Plan.

Cumulative Effects

Although private land owners and other federal, state, and local governments administering lands adjacent to the SCNF would continue invasive plant treatment activities, implementation of the No Action would contribute to increased occurrence and spread of infestations on these lands. Untreated infestations in the SCNF would lead to a long-term decline in the health and sustainability of native plant communities. This would result in economic losses to businesses in the area that depend on healthy and functional native plant communities. The agricultural and recreational based economy would be adversely impacted by spread of invasive plants from SCNF lands. Costs incurred by adjoining land ownerships to treat invasive plant infestations would likely continue to escalate as a result of the increasing likelihood and scale of the spread of these species from untreated areas of the SCNF.

3.9.6.4. Alternative 2 - Current Action

Direct and Indirect Effects

The Current Action alternative offers a limited amount of management opportunities to address the spread of non-native invasive plants. The EDRR component, although present, is not as robust as the other action alternatives and the restoration component is not developed. This alternative has nothing to address the treatment of invasive aquatic plants. If an aquatic plant were to be found, valuable time would be lost getting appropriate authorizations of treatment methods that could be used to eradicate a small, newly identified infestation. The ability to treat large infestations in the most cost-effective manner would not be available. Restoration and rehabilitation efforts are not emphasized in this alternative; therefore the opportunities to improve the resiliency of native plant communities would be limited.

Table 3-69: Cost of Maximum Applied Acres by Treatment Method- Alternative 2

Treatment Method	Maximum Acres	Estimated Cost Per Acre	Total Cost
Biocontrol	400	$165	$66,000
Manual (hand-pulling)	40	$3,572	$142,880
Ground-based Herbicide Spraying	5,500	$69-199	$379,500-1,094,500
Total Acres/Average Cost Per Acre[1]	**5,500**	**$134**	

[1]Cost and acreage of biocontrol and manual treatment not factored into total

Cumulative Effects

The Current Action alternative offers a limited amount of management opportunities to address the spread of non-native invasive plants. The EDRR component, although present, is not as robust as the other action alternatives and the restoration component is not developed. This alternative has nothing to address the treatment of invasive aquatic plants. If an aquatic plant were to be found, valuable time would be lost getting appropriate authorizations of treatment methods that could be used to eradicate a small, newly identified infestation. The ability to treat large infestations in the most cost-effective manner would not be available. Restoration and rehabilitation efforts are not emphasized in this alternative; therefore the opportunities to improve the resiliency of native plant communities would be limited.

3.9.6.5. Alternative 3 - Proposed Action

Direct and Indirect Effects

The Proposed Action offers the most robust management opportunities to address the increase of non-native invasive plants. The additional herbicides that would be authorized are more effective on target species and have greater persistence, thus requiring fewer treatments. Aerial application is the least expensive application method; therefore the most cost-effective tool to treat large and inaccessible infestations would be available for use. This alternative provides EDRR treatment alternatives of aquatic invasive plants which would allow for the timely possible eradication of a small, newly discovered infestation. Restoration and rehabilitation efforts would be employed in a more coordinated and efficient manner which would improve effectiveness and result in the improvement of the health and sustainability of native plant communities.

Table 3-70: Cost of Maximum Applied Acres by Treatment Method- Alternative 3

Treatment Method	Maximum Acres (Applied)	Estimated Cost Per Acre	Total Cost
Biocontrol	2,000	$165	$330,000
Manual (hand-pulling)	2,000	$3,572	$7,144,000
Ground-based Herbicide Application	3,200	$69-199	$220,800-636,800
Aerial Herbicide Application	8,000	$59	$472,000
Total Acres/Average Cost Per Acre[1]	**11,200**	**$80**	

[1]Cost and acreage of biocontrol and manual treatment not factored into total

Cumulative Effects

This alternative likely would address the spread of terrestrial invasive plants from and onto adjacent land owners. It would provide prevention and EDRR guidance and would allow for the greatest scale and scope of treatment. Large and inaccessible infestations could be managed, which could reduce the spread and density of invasive species and cause of restoration and rehabilitation activities to be

more effective. The result would be the subsequent improvement in the health and sustainability of native plant communities. Aquatic invasive plant infestations could be treated soon after detection which may prevent the spread of these species into the waters on the SCNF. All of these in combination would result in economic benefit to businesses in the area that depend on healthy and functional native plant communities.

3.9.6.6. Alternative 4 - No Aerial Herbicide Application

Direct and Indirect Effects

This alternative is very similar to the Proposed Action except it does not allow for an effective treatment of inaccessible or widespread infestations. Otherwise, effects would be similar to the Proposed Action.

Cumulative Effects

This alternative likely would address the spread of terrestrial invasive plants from and onto adjacent land owners. It would provide prevention and EDRR guidance, but would be limited in the scale and scope of treatment. Large and inaccessible infestations would remain largely unmanaged, which could result in continued spread of invasive species and subsequent decline in the health and sustainability of native plant communities. Deferring or delaying the treatment of invasive plant populations would result in increased future costs to the Forest Service and thus to tax payers to treat larger, more widespread populations that would continue to develop over time. The spread of large infestations could result in economic losses to businesses in the area that depend on healthy and functional native plant communities.

Table 3-71: Cost of Maximum Applied Acres by Treatment Method- Alternative 4

Treatment Method	Maximum Acres (Applied)	Estimated Cost Per Acre	Total Cost
Biocontrol	2,000	$165	$330,000
Manual (hand-pulling)	2,000	$3,572	$7,144,000
Ground-based Herbicide Application	6,400	$69-199	$441,600-1,273,600
Aerial Herbicide Application	0	$59	0
Total/Average Cost per Acre[1]	**6,400**	**$134**	

[1]Cost and acreage of biocontrol and manual treatment not factored into total

3.9.6.7. Alternative 5 - No Aquatic Herbicide Application

Direct and Indirect Effects

This alternative is very similar to the Proposed Action except it does not allow for EDRR response to aquatic invasive plants. Otherwise, effects would be similar to the Proposed Action.

Cumulative Effects

This alternative likely would address the spread of terrestrial invasive plants from and onto adjacent land owners. It would provide prevention and EDRR guidance and would allow for the greatest scale and scope of treatment. Large and inaccessible infestations could be managed, which could reduce the spread and density of invasive species and cause of restoration and rehabilitation activities to be

more effective. The result would be the subsequent improvement in the health and sustainability of native plant communities. Aquatic invasive plant infestations could spread and increase before treatment methods could be authorized for use. Deferring or delaying the treatment of aquatic invasive plant populations would result in increased future costs to the Forest Service and thus to tax payers to treat larger, more widespread populations that would continue to develop over time. The potential for the spread of aquatic invasive plants could result in economic losses to businesses in the area that depend on healthy and functional aquatic communities.

3.10. Cultural Resources

3.10.1. Introduction

The Salmon-Challis National Forest contains numerous archaeological sites that are eligible for listing in the National Register of Historic Places. Invasive plant infestations and some of the methods used to control invasive plants, may negatively impact archaeological sites. Any mechanical or cultural invasive plant control method that has the potential to cause ground disturbance would be treated as a federal action and would follow the National Historic Preservation Act of 1966 (NHPA) Section 106 process.

Incidental weed pulling will not trigger Section 106 review, as there is a very low probability that it would have an adverse effect on an archaeological site. Incidental weed pulling is defined as 1) removing individual weeds by hand, without the aid of a tool, 2) occurs during chance discovery of weeds. Incidental weed pulling can be used anytime as an unplanned and expedient control method. A planned weed control project incorporating pulling as part of its control methods will be subject to Section 106 review as a federal action.

3.10.2. Compliance with Forest Plan and Other Relevant Direction

The primary legislation governing heritage management is the NHPA of 1966 (amended in 1976, 1980, and 1992). All other heritage resource management laws and regulations support, clarify, or expand on the National Historic Preservation Act. Federal Regulations 36 CFR 800 (Protection of Historic Properties), 36 CFR 63 (Determination of Eligibility to the National Register of Historic Places, 36 CFR 296 (Protection of Archaeological Resources), and Forest Service Manual 2360 (FSM 2360) provide the basis of specific Forest Service heritage resource management practices. These laws and regulations guide the SCNF in identifying, evaluating, and protecting heritage resources.

Under Section 106 of the NHPA, the Forest Service is required to evaluate effects of proposed management activities on historic properties (archaeological sites and ethnographic resources including traditional cultural properties). The SCNF follows the Salmon and Challis forest plans' standards and guidelines for protecting heritage resources and coordinating with Native American tribes (Challis National Forest Land Resource Management Plan, Section IV.A.1 and Section IV.B.1.c.1; and Salmon National Forest Land and Resource Management Plan pp. IV-83).

This document analyzes proposed invasive plant treatment activities in accordance with NEPA, and the Section 106 NHPA process requirements.

3.10.3. Methodology for Analysis

The source of information for the Affected Environment includes archeological resource surveys that have been conducted in the SCNF. This analysis examines each of the alternatives' potential to effect archaeological sites in the SCNF.

Analysis Area

The project area is the analysis area.

3.10.4. Affected Environment

Heritage resources are nonrenewable resources easily damaged by ground-disturbing activities. Most sites are susceptible to damage from ground disturbance. Ground disturbing activities can churn or displace archaeological deposits and destroy the site's potential to yield important scientific information.

Manually digging or pulling invasive plants could cause surface disturbance and displacement of buried archaeological materials. Tilling and reseeding can damage artifacts and alter archaeological deposits. Tilling can mix organic material in archeological sites could contaminate carbon 14 dating samples, making them unreliable for scientific analysis. In addition, torching could destroy historic wood, metal, glass, and leather artifacts laying exposed on the ground surface.

Invasive plant control treatments that reduce the vegetation cover on archaeological sites can make them more visible and increase the risk of illegal artifact collecting. Removal of invasive plants by any method could expose bare soil and increase soil erosion, which can adversely affect archaeological sites.

In order to prevent adverse effects to archaeological sites, all proposed invasive plant control measures utilizing mechanical or cultural methods would be analyzed as individual federal actions, and would be reviewed in accordance with Section 106 of the NHPA. An archaeological survey would be conducted for all areas where mechanical or cultural methods are proposed if those methods have the potential to disturb the ground and they occur in areas with a high probability of finding archaeological sites.

High probability areas are:

- Within 100 meters of springs or reliable water sources
- Have slopes less than 20%
- Major ridges
- Near historic roads and trails
- Near historic mining districts
- Near other areas used in historic times (e.g. homesteads, USFS administrative sites)

No archaeological survey is necessary if the treatment area has:

- been previously disturbed to the degree that there is no possibility of it containing an intact archaeological site
- had an adequate archaeological survey conducted in the past

If a National Register eligible site is found within an invasive plant treatment area, the final treatment plan would be crafted so that there would be no adverse effect to the site.

If artifacts or archaeological features are discovered during the application of mechanical and/or cultural methods, work would stop in that location and a Forest Service archaeologist would be notified.

There are 1168 archaeological sites within the analysis area that are either National Register listed or eligible (n=660) or have not yet been evaluated (n=508). Of the 11168 sites, 240 are located in mapped invasive plant locations. There probably are many unrecorded sites in the analysis area and in the mapped invasive plant locations, as much of the area has not been surveyed for archaeological sites.

Of the 1168 sites 462 are prehistoric, 646 are historic, 55 are multicomponent, and 5 need to be evaluated. The prehistoric sites consist of house-pit villages, lithic sites, pictograph sites, rock shelters, sheep traps, and talus pits. The historic sites are composed of cabins, ditches, dumps, graves, guard stations, lookouts, mines, ranches, roads, ruins, and trails.

3.10.5. Environmental Consequences

3.10.5.1. Alternative 1-No Action

Direct and Indirect Effects

There would be no direct effects to archaeological sites. Invasive plant infestations may alter an area's fire ecology, making it more prone to fire (Whisenant 1989, Billings 1992, Brooks and Pyke 2001). Historic buildings located in such an area would be at greater risk of loss to fire. Fire can damage pictograph sites by altering the pigments or causing the rock medium to spall. Greater fire frequency caused by invasive plants can increase exposure to this risk.

3.10.5.2. Alternative 2-Current Action

Direct and Indirect Effects

The Current Action utilizes mechanical and cultural methods for controlling invasive plants, both of which can adversely affect archaeological sites. An archaeologist is consulted prior to initiation of work when the method to be used has the potential to result in ground disturbance deep enough to affect cultural resource sites. If a known archaeological site is in the area, the site is avoided.

3.10.5.3. Alternative 3-Proposed Action, Alternative 4-No Aerial Herbicide Application and Alternative 5-No Aquatic Herbicide Application

Direct and Indirect Effects

The proposed action alternatives utilize mechanical and cultural methods for controlling invasive plants, both of which can adversely affect archaeological sites.

All proposed invasive plant control measures utilizing mechanical or cultural methods would be analyzed as individual federal actions, and would be reviewed in accordance with Section 106 of the NHPA. The SCNF would conduct an archaeological survey of all areas where mechanical or cultural methods are proposed if those methods have the potential to disturb the ground and they occur in areas with a high probability of finding archaeological sites.

No archaeological survey is necessary if the treatment area has:

1. been previously disturbed to the degree that there is no possibility of it containing an intact archaeological site
2. had an adequate archaeological survey conducted in the past

If a National Register eligible site is found within an invasive plant treatment area, the final treatment plan would be crafted so that there would be no adverse effect to the site.

If artifacts or archaeological features are discovered during the application of mechanical and/or cultural methods, work would stop in that location and a Forest Service archaeologist would be notified.

Cumulative Effects for All Alternatives

There would be no cumulative effects for any of the alternatives.

3.11. Climate Change

3.11.1. Introduction

This section analyzes the potential for effects from and to climate change resulting from implementation of the alternatives both from the impacts of invasive plants and the impacts of invasive plant control.

3.11.2. Compliance with Forest Plan and Other Relevant Direction

The Washington Office gave direction in 2009 regarding the inclusion of climate change considerations in NEPA analysis (USDA Forest Service 2009). The National Roadmap for Responding to Climate Change was developed in 2011. The Roadmap outlines actions to be taken by the agency-assessing risks, vulnerabilities, policies, and knowledge gaps; engaging employees and the public; and management actions that include adaptation and mitigation. This document identifies that Forest Service policies were developed before climate change was identified as an issue, and that the agency is currently working on realigning policies to meet effective climate change response

(USDA Forest Service 2011). For the same reason, the Forest Plans do not contain any references to climate change, since they were written before this became a widely recognized issue.

EO 13693, Planning for Federal Sustainability in the Next Decade, requires per-mile greenhouse gas emissions from agency fleet vehicles be reduced over the next decade. Although this requirement is not within the scope of the analysis of this project, agency policy is to reduce overall GHG emissions. The intent would be that vehicles used to implement invasive plant treatment activities would be replaced with lower-emission and more fuel efficient vehicles over the life of the project.

3.11.3. Methodology for Analysis

Analysis was done utilizing relevant research, agency guidance, climate model scenarios, and other information applicable to climate change and invasive plant treatments.

Project-level analysis for climate change followed USDA Forest Service Washington Office direction (2009). The four concepts emphasized are:

- Climate change effects include the effects of the action of global climate change as well as the effects of climate change on the proposed project;
- Projects may be proposed that can increase the adaptive capacity of an ecosystem, mitigate climate change effects on ecosystems, or sequester carbon;
- It is not currently feasible to quantify indirect effects of individual or even multiple projects on global climate change, therefore determining significant effects on proposed projects or alternatives on global climate change cannot be made; and
- Some project proposals may present choices based on quantifiable differences in carbon storage and GHG emissions between alternatives.

Analysis Area

The analysis area for effects is addressed at a three county level.

3.11.4. Affected Environment

Climate Change

Climate change is a term that refers to significant change in the measure of climate, such as temperature, precipitation, and wind patterns, which last for an extended period of time- several decades or longer. Global average surface temperatures have increased 1.33°F (0.74°C) over the last century. Excessive greenhouse gases in the atmosphere resulting from anthropogenic activities, notably carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (NO_2), are measureable and significant contributors to global warming. Concentration rates of CO_2 in the atmosphere were at 391 ppm in 2011, the highest level of any point in the last 800,000 years. Most of the increase has occurred since the mid-20th century (CCRC 2012). Scenarios for climate change have been modeled for the Pacific Northwest. For temperature, the rate of change is expected to be greater. Climate models predict warming of 0.5 F (0.3 C) per decade through 2050; after that the rate depends on the amount of greenhouse gas emissions. The total amount of temperature change is expected to be greater; average annual temperature is predicted to increase 2.0° F (1.1° C) by the 2020s, 3.2° F (1.8° C) by the 2040s, and 5.3° F (3.0° C) by the 2080s. All seasons are expected to be warmer, with the greatest temperature increase occurring in the summer months and the average annual

temperature will likely exceed the range of 20th century variability (CIG 2008). Models for changes in precipitation are less certain than those for temperature. That being said, models indicate that there is no projected change in the annual average precipitation. Existing seasonal patterns of precipitation could be emphasized; models show an increase in winter precipitation. However, the overall winter precipitation is expected to fall as rain rather than snow. The average annual precipitation is expected to stay within the 20th century range of variability; however, it is unknown how the intensity of the precipitation may change (CIG 2008).The NASA Earth Exchange Downscaled Climate Projections (NEX-DCP30) data set includes downscaled projections from 33 models and statistics from the four Representative Concentration Pathways (RCP) greenhouse gas emission scenarios that spans the 21st century. The mapping product, NEX-DCP30 Viewer, displays the data at a county-wide level (US Geological Service 2013). Data for the analysis area are displayed below.

Table 3-72: Average Annual Current and Predicted Temperatures and Precipitation by County (1850-2005 vs. 2050-2074)

	Butte County	Custer County	Lemhi County
Maximum Temp Current (°C)	12.6	9.5	10.1
Maximum Temp Predicted (°C)	16.3	13.2	13.8
Maximum Temp Change (°C)	+ 3.72	+ 3.69	+ 3.63
Minimum Temp Current (°C)	-2.4	-4.3	-2.9
Minimum Temp Predicted (°C)	-1.6	-3.0	1.0
Minimum Temp Change (°C)	+ 4.07	+ 3.95	+ 3.88
Precipitation Current (mm[1]/day)	0.9	1.7	1.5
Precipitation Predicted (mm/day)	0.9	1.8	1.6
Precipitation Change (mm/day)	+ 0.06	+ 0.11	+ 0.08

[1]mm: millimeters

Effects on Invasive Plants

Invasive plants tend to have traits such as broad environmental tolerances, short juvenile periods, and long-distance dispersal mechanisms that favor changing conditions (Hellmann et al. 2008). Climate change may be advantageous to invasive species that can shift ranges quickly and/or tolerate wide ranges of environments (Dukes and Mooney 1999).

Climate change can alter transport and introduction mechanisms; human transport will likely increase invasion of some non-native species from none to a level that allow for establishment. Survivorship of invasive species will be enhanced during transport; for example the loss of sea ice could substantially decrease travel time for some ships. There will also be more purposeful introductions for ornamental or conservation purposes (Hellmann et al. 2008). A larger number of non-native species cultivated as ornamentals and currently considered as benign represent a substantial group of potentially damaging species should environmental conditions shift in their favor allowing the plants to disperse in the wild outside of cultivated conditions as a result of global climate change (Sutherst 2000 in Runyon et al. 2012). Changes in land-use patterns that increase habitat fragmentation and alter disturbance regimes will tend to benefit invasive plants (Dukes and Mooney 1999). Disturbances themselves may not result in exotic species invasions, but provide an environment conducive to invasion. Post-disturbance invasion may be problematic in areas adjacent to invasive plant seed sources (wildland-urban interfaces), influenced by important pathways (roads), and have vectors present (e.g. recreationalists) (Kerns and Guo 2012).

Considerable change in invasive species distribution may occur due to changing climatic constraints. Species that are currently unsuccessful invaders may become successful if conditions become more

similar to their native range (Hellmann et al. 2008). Some invasive species, such as currently small, non-dominant populations, have the potential for expansion. Other species may have reduced invasion risk and range contractions. Reduced climactic suitability on currently invaded lands may make invasive species less competitive, potentially leading to retreat. However, native plants may be unable to reoccupy because of the same reasons. In the absence of active management, new invasive species may quickly become established in areas where more established invasive species are less competitive. Without intervention, the opportunity for restoration presented by climate change may quickly disappear (Bradley et al. 2009).

Hydrologic constraints will be altered due to changing precipitation patterns and frequency (Hellmann et al. 2008). Precipitation is the most variable, yet the best predictor of invasive plant distribution in the western United States (Bradley et al. 2009). Short term water availability can facilitate long-term establishment of invasive plants (Dukes and Mooney 1999). However, the high uncertainty of precipitation-based predictions is due to the inherent difficulty in projecting future precipitation as compared to temperature predictions (Runyan et al. 2012).

Cold temperature constraints will be reduced at higher latitudes and elevations and warm temperatures will increase at lower latitudes and elevations. Invasive species currently limited by freezes or ice cover will no longer have the same constraints (Hellmann et al. 2008). Studies have documented the movement of species poleward and/or upward in elevation which has been hypothesized as a response to warming (Chen et al. 2011, Guo et al. 2012). Invasive species may be able to move to higher latitudes and/or elevations faster than native species due to higher dispersal ability and genetic flexibility (Kerns and Guo 2012). The risk of exotic invasive plants entering forests is likely highest in mountain ecosystems (Ryan and Vose 2012).

Studies have indicated that increased nitrogen resulted in a decrease of species richness and a transient dominance of early successional species (Tilman 1987, Reich 2009). Exotic plant species cover is positively correlated with the mean soil percentage of nitrogen (Stohlgren et al. 1999). Increased nitrogen deposition favors fast-growing plant species and disadvantages slow-growing, usually native, plants that are adapted to nutrient poor soils (Dukes and Mooney 1999). However, studies have indicated that elevated CO_2 could reduce the negative effects of nitrogen enrichment on species richness in some cases (Reich 2009). Many invasive plants respond positively to elevated CO_2 levels, especially when growing in monocultures. However, it is not possible to predict which plant species will benefit or be detrimentally affected by increased CO_2 levels. Some species, such as nitrogen-fixers, increase water use efficiency when grown in CO_2 enriched environments. Some studies suggest that elevated CO_2 may slow successional recovery of some plant communities, which would increase dominance of invasive species in some ecosystems (Dukes and Mooney 1999). While a large number of invasive species respond strongly to elevated CO^2 levels, overall responses were found to not be statistically different from the responses of non-invasive plants within the same functional group (Runyon et al. 2012). Invasive species that modify habitat (such as changing nitrogen levels or prevent establishment of other species) will themselves generate changes in biodiversity (Myers et al. 2004).

It may be possible to predict how a particular species may respond to modifications in temperature, precipitation, or habitat disturbance associated with climate change; however, it is not possible to generalize. Predictions of impacts of climate change on invasive plants are very complex and imprecise (Myers et al. 2004).

Effects on Biocontrols

There is concern that some biocontrol methods may become ineffective with climate change (Kerns and Guo 2012). The success of biocontrol programs must be considered in attempts to predict the effects of climate change on invasive plants; some biocontrol agents will become more effective, some will become less effective (Hellmann et al. 2008; Myers et al. 2004). Climate change has the potential to alter interactions between plants and herbivores. Elevated CO^2 and temperature could affect the susceptibility or resistance of plants to herbivory by modifying plant chemistry such as nutrient levels or defense compounds. Increased CO^2 can affect levels of insect feeding by increasing sugars in leaves. Very little is known about how these changes will affect individual plant-insect relationships or broader community interactions (Runyon et al. 2012).

Effects on Herbicides

Climate change may have an impact on the effectiveness of herbicides. Studies have indicated that the tolerance to herbicides will increase in some species as a result of increasing CO^2 levels (Hellmann et al. 2008; Kerns and Guo 2012). The possible effects of increased CO^2 and temperature on herbicides are decreased foliar absorption; limited uptake of soil applied herbicides; and reduced windows of target plant susceptibility. Increased CO^2 could affect herbicide performance by reducing the control of perennial invasive plants due to an increase in below-ground growth and alteration of herbicide specific chemistry (Menalled unk. year). The ability of dry land vegetation communities to rebound after herbicide applications may be compromised under climate change scenarios (Runyon et al. 2012). Due to the complexity different herbicides have on microbial physiological metabolism, accurate predictions are difficult to make. Long-term naturalized studies need to be carried out to understand the effects of greenhouse gas emissions on herbicides (Xue 2012).

3.11.5. Environmental Consequences

Climate change is anticipated to alter temperature and precipitation which could benefit certain existing invasive species and lead to the infestation of new species. It is likely that the range of invasive species could expand, notably to higher elevations and more northerly latitudes. Landscape level disturbances, such as wildfire, would be expected to continue and increase in scale and intensity. Overall, climate change will likely increase the establishment of invasive plants in National Forests (Ryan and Vose 2012).

3.11.5.1. Alternative 1-No Action

Direct and Indirect Effects

No early detection/ rapid response strategy combined with the lack of any control methods would allow for the relatively unchecked spread of non-native invasive plants, which in turn could impact other ecosystem processes such as wildlife habitat quality and fire return intervals. No restoration activities would occur, so there would be no opportunities to improve the resiliency of native plant communities. The No Action alternative does not comply with recommendations that address the increase of non-native invasive plants resulting from the effects of climate change (USDA Forest Service 2011).

3.11.5.2. Alternative 2-Current Action

Direct and Indirect Effects

The Current Action alternative offers a limited amount of management opportunities to address the increase of non-native invasive plants resulting from the effects of climate change. The EDRR component, although present, is not as robust as in the other action alternatives and the restoration component is not developed.

3.11.5.3. Alternative 3-Proposed Action

Direct and Indirect Effects

The Proposed Action offers the most robust management opportunities to address the increase of non-native invasive plants resulting from the effects of climate change. Recommendations to address climate change include the development of a toolbox of management options, reduction of existing stresses (of which EDRR is a component), creation of resistance and promotion of resilience to climate change, and enabling ecosystems to adapt to climate change (Joyce et al. 2008). The Proposed Action contains components of all those recommendations.

3.11.5.4. Alternative 4-No Aerial Herbicide Application

Direct and Indirect Effects

This alternative is very similar to the Proposed Action except it does not allow for an effective treatment of inaccessible or widespread infestations. Otherwise, effects would be similar to the Proposed Action.

3.11.5.5. Alternative 5-No Aquatic Herbicide Application

Direct and Indirect Effects

This alternative is very similar to the Proposed Action except it does not allow for EDRR response to aquatic invasive plants. Otherwise, effects would be similar to the Proposed Action.

Cumulative Effects for All Action Alternatives

The action alternatives likely would not impact greenhouse gas emissions; rather the overall temperature increases and precipitation pattern changes would affect the rate, spread, and species composition of non-native invasive plants. There is a tremendous amount of uncertainty regarding the effects of climate change over any specific location within the timeframe of this project, therefore cumulative effects from all alternatives are unable to be determined either quantitatively or qualitatively.

3.12. Tribal Consultation

Federally recognized tribes with aboriginal territory within the current project area include the Shoshone-Bannock Tribes and the Nez Perce Tribe. Under Section 106 of the NHPA, federal

agencies are required to consult with any Indian tribe that may attach religious or cultural significance to properties located within the project area (16 USC 470a(d)(6)(A) and (B)). Traditional Cultural Properties (TCPs) can include the locations of historic events, sacred areas, sources of raw material for tool making, traditional hunting and plant gathering areas, and natural features. The Forest Service has a federal trust responsibility to the Tribes to manage Forest Service lands under their jurisdiction in a manner to preserve and protect Treaty resources on behalf of the Tribes.

A prevention and treatment plan for invasive plants has the potential to have a short term effect on tribal members' ability to use and access the SCNF including hunting, fishing, and gathering. Other tribal concerns include the spread of invasive plants which can affect native plant populations. The treatment of invasive plants has the potential to impact water quality, fish and fish habitat, wildlife and wildlife habitat, and the ability of tribal elders to hunt and gather these resources. Few TCPs have been documented through consultation with the Tribes. This is primarily due to privacy issues. For this analysis, we assume that the SCNF was, and is, used for traditional activities such as hunting, fishing, and gathering and traditional practices such as ceremonies and religious practices. To protect the privacy of the Tribes, these activities are analyzed in general terms. Many tribal members hunt, fish, and gather for subsistence and to maintain their traditional way of life.

The implementation of a prevention and treatment plan for invasive plants would not affect tribal reserved treaty rights. The Shoshone-Bannock and Nez Perce Tribes would continue to be able to exercise their off-reservation treaty rights. Further Government-to-Government consultation would be conducted regarding invasive plant prevention and treatment as it might affect traditional activities.

Shoshone-Bannock Tribes

Notification and involvement of the Shoshone-Bannock Tribes and the Nez Perce Tribe concerning Native American cultural resource matters was carried out as specified by the Code of Federal Regulations 36 CFR 296.7, 36 CFR 800 Section 101(d)(6)(B) and in accordance with Presidential Memorandum concerning Government-to-Government consultation signed April 29,1994. The relationship of the U.S. Government with American Indian tribes is based on legal agreements between sovereign nations. The Fort Bridger Treaty of July 3, 1868, reserved hunting and fishing rights to Shoshone–Bannock tribal members on "all unoccupied lands of the United States." This right applies to all public domain lands that were reserved for National Forest System purposes that are presently administered by the Salmon-Challis National Forest. These rights are still in effect, and management actions recognize these rights. The reserved rights include hunting, fishing, and gathering. While the Treaty itself only specifies hunting, the lawsuit "State of Idaho vs. Tinno" established that any rights not specifically given up in the Treaty were, in fact, reserved by the Tribes.

The invasive plant prevention and treatment plan was discussed during regularly scheduled SCNF-Shoshone-Bannock Tribes staff-to-staff meetings on May 3, 2012, October 4, 2012, November 21, 2013, and October 6, 2014. Salmon-Challis NF staff also met with Shoshone-Bannock staff on June 11, 2012 in Fort Hall, ID to discuss specifics of the invasive plant prevention and treatment plan. Tribal staff expressed concern regarding several issues including treatment of invasive plants within areas utilized by tribal members for gathering resources such as (but not limited to) bitterroot, chokecherry, elderberry, current, willow, and lodgepole pine. Tribal elders are often not physically able to pursue their plant gathering activities far from established roadways so chemical treatments

in these areas is especially troubling. A web-based notification system was suggested where tribal members could determine the location of active treatment prior to venturing into the Forest.

In addition to these staff-to-staff meetings, letters dated July 8, 2011 and April 12, 2012 were sent to the Fort Hall Business Council Chairman and staff summarizing the Proposed Action and inviting the Business Council to comment on the proposal. No comments were received from the Tribes.

Nez Perce Tribe

In the Nez Perce Treaty of 1855, Article 3, the United States of America and the Nez Perce Tribe mutually agreed that the Nez Perce retain the right of "… taking fish at all usual and accustomed places in common with citizens of the Territory [of Idaho]; and of creating temporary buildings for curing, together with the privilege of hunting, gathering roots and berries, and pasturing horses and cattle…" These rights apply to all public domain lands that were reserved for NFS purposes that are presently administered by the SCNF. These rights are still in effect, and management actions recognize these rights.

A letter dated April 12, 2012 was sent to the Nez Perce Tribal Executive Committee (NPTEC) summarizing the Proposed Action and inviting the NPTEC to comment on the proposal. No comments were received from the Tribe.

3.12.1. Compliance with Forest Plan and Other Relevant Direction

The alternatives analyzed comply with the management direction for tribal resources provided in the respective Land and Resource Management Plans for the Salmon and Challis National Forests. These are the Challis National Forest Land and Resource Management Plan dated June 3, 1987 (as amended) and the Salmon National Forest FEIS and Land and Resource Management Plan dated January 11, 1988 (as amended). They also comply with relevant Federal regulations and policies concerning the tribal resource.

3.12.2. Affected Environment

The relationship of the U.S. Government with American Indian tribes is based on legal agreements between sovereign nations. Federally recognized tribes with aboriginal territory within the current project area include the Shoshone-Bannock Tribes and the Nez Perce Tribe. Treaties between these tribes and the United States continue to be enforced. At meetings with the Shoshone-Bannock Tribes regarding federal trust responsibilities, the major issues pertinent to the SCNF have been:

- Protection of big game winter range, especially for elk, moose, bighorn sheep, deer, antelope, and mountain goat;
- Protection of small game and mammals;
- Protection of water resources;
- Protection of resident indigenous and anadromous fish habitat;
- Access to traditional plant resources, such as, but not limited to, bitterroot, chokecherry, elderberry, currant , willow, and lodge pole pine collection areas; and
- Unrestricted access for hunting, fishing, and gathering.

Few if any actual Traditional Use sites have ever been documented through consultation with the Tribes, mainly because of confidentiality issues. These are sites historically used by Tribes for traditional land uses such as hunting, fishing, gathering, ceremonial, and religious practices for which the Federal government has trust responsibilities to the Tribes. Federal consultation is essential to ensure that the federal government's trust obligations to the Tribes are met.

Canaday (2012) and Matz (1995) provide overviews of the Shoshone-Bannock Tribes and the Nez Perce Tribe that is relevant to the current discussion. The Shoshone-Bannock peoples' aboriginal lands are vast and far-ranging and encompass a large geographic area of the United States. Rivers, including the Snake, Missouri, and Colorado River Basins, provided for the subsistence needs of the various bands, including the fish eaters, *Agai-dika*, the buffalo eaters, *Kutsu-dika*, the bighorn sheep eaters, *Tudu-dika*, and other bands who eventually ended up at the Fort Hall Reservation. Natural resources associated with a riverine ecosystem provided food, medicine, shelter, clothing and other uses and purposes intrinsic to traditional practices. Hunting for fish, wildlife and native plant resources was an important subsistence practice.

In June 1867, an Executive Order established the Fort Hall Indian Reservation, as a collective place to consolidate the various bands of Shoshone, Bannocks and even other tribes, from their aboriginal lands, clearing the way for European-American settlers, such as ranchers and miners who desired rich resources present on aboriginal lands. The United States signed the Fort Bridger Treaty of 1868 with Shoshone and Bannock headmen, relinquishing any further claims to lands and title, but expressly reserving the right to hunt, fish and gather on unoccupied lands in the United States, in Article 4 of the Treaty.

The Lemhi Reservation was established by executive order on February 2, 1875 and encompassed 100 square miles immediately adjacent to what would later be encompassed by the Salmon-Challis National Forest. The reservation was home to about 700 *Agai-dikas*, *Tudu-dikas*, and Northern Bannocks. Opposition to the reservation by settlers and Washington policy makers was immediate resulting in the cession of the reservation by an Act of Congress in 1888. Conflicts between settlers, missionaries and miners and Indian tribes occurred throughout the 19th Century resulting in the forced removal of tribal people from the area. Many Lemhi Shoshone refused to leave the Lemhi Reservation until 1907 when over 500 traveled to the Fort Hall Reservation. The Lemhi Shoshone continue to travel back to the Lemhi Valley to hunt, fish, and visit with relatives who remained behind in the Salmon area.

Today, descendants of the Lemhi, Boise Valley, Bruneau, Weiser and other bands of Shoshone and Bannock people reside on the Fort Hall Reservation as the Shoshone-Bannock Tribes political subdivision. Tribal members continue to exercise off reservation treaty rights and return to aboriginal lands to practice their unique culture and traditions.

The Fort Bridger Treaty of July 3, 1868 between the Shoshone-Bannock Tribes and the United States retained hunting and fishing rights to Shoshone–Bannock tribal members on "all unoccupied lands of the United States." This right applies to all public domain lands that were reserved for NFS purposes that are presently administered by the SCNF. These rights are still in effect, and management actions recognize these rights.

The Shoshone-Bannock Tribal government encourages maintaining and restoring all lands to healthy ecosystems. The policy of the Shoshone-Bannock Tribes for management of Snake and Salmon

River Basin resources suggests drastic efforts to restore the ecosystem only when past uses have degraded the area's ability to naturally recover. The least intrusive restoration efforts should be used. Invasive plant control efforts would have direct and indirect effects on these Tribal policies, since the alternatives all include some manipulation of the existing SCNF ecosystem, but with an overall goal of ecosystem restoration. Tribal information about hunting, fishing, gathering, and religious use is closely guarded by Tribal members. The SCNF watersheds provide important habitat for culturally significant species like salmon as well as traditional hunting opportunities for deer, elk and bighorn sheep, etc. The Tribes also have rights to gather various plant species that occur in the SCNF. Invasive plants can affect these plant populations and contribute to habitat degradation. The Shoshone-Bannock Tribes also have areas of religious and cultural concern such as cemeteries, burial areas, and ceremonial areas; these locations are also closely guarded and are considered to be confidential information. Because invasive plant control efforts may affect these areas and Tribal uses of the SCNF, Government-to-Government consultation would be a continuing process.

In the Nez Perce Treaty of 1855, Article 3, the United States of America and the Nez Perce Tribe mutually agreed that the Nez Perce retain the right of "… taking fish at all usual and accustomed places in common with citizens of the Territory [of Idaho]; and of creating temporary buildings for curing, together with the privilege of hunting, gathering roots and berries, and pasturing horses and cattle…" These rights apply to all public domain lands that were reserved for NFS purposes that are presently administered by the SCNF. These rights are still in effect, and management actions recognize these rights. The Nee Mee Poo National Historic Trail crosses SCNF land. It traces the route traveled by bands of Nez Perce people in 1877 as they were pursued by the U.S. Army. The Nez Perce Tribe has claimed no present interest east of the Middle Fork of the Salmon River except for actions potentially affecting water quality and anadromous fish resources.

3.12.1. Environmental Consequences

The administration of Indian Trust Assets is the responsibility of the federal government. Meetings with the Shoshone-Bannock Tribes have yielded important concerns that would potentially be affected by the invasive plant prevention and treatment plan. These are:

- Protection of big game winter range, especially for elk, moose, bighorn sheep, deer, antelope, and mountain goat;
- Protection of small game and mammals;
- Protection of water resources;
- Protection of resident indigenous and anadromous fish habitat;
- Access to traditional plant resources, such as, but not limited to, bitterroot, chokecherry, elderberry, currant, willow, and lodge pole pine collection areas; and
- Unrestricted access for hunting, fishing, and gathering.

3.12.1.1. Alternative 1 – No Action

Direct and Indirect Effects

Direct and indirect effects of this alternative would include expansion of invasive plants resulting in an overall reduction of native plants available for tribal use. The continued spread of invasive plants would have adverse direct and indirect effects on native plant communities, potentially including those used by Native American Tribes. invasive plants can decrease plant diversity, structure, and

function in native plant communities by outcompeting native species for available resources. Big game winter range would also be affected, as invasive plants continue to spread into these areas. Other Indian Trust wildlife issues (such as big game and wildlife with religious or cultural significance) would be directly affected by loss of cover, forage, and habitat. Other Trust Assets that would also be directly affected are anadromous fisheries and their habitat, which may experience degradation due to increased sediment delivery to streams from increasing invasive plant infestation. Indirect effects would occur as infested riparian habitat changes to a less diverse plant community. Soil degradation from invasive plant invasions would indirectly affect these Trust resources as water quality declines and sediment increases.

Cumulative Effects

In order to understand the contribution of past actions to the cumulative effects of this alternative, this analysis relies on current environmental conditions as a proxy for the impacts of past actions. This is because existing conditions reflect the aggregate impact of all prior human actions and natural events that have affected the environment and might contribute to cumulative effects. Future actions are those that are within the bounds of the existing Forest Plans.

All ground disturbing activities which are likely to occur on the Forest create the potential to establish invasive weed populations, or where they already exist, enhance the rate of spread. Although it is standard procedure to address these concerns during planning on a case by case basis (prevention), there is the concern that if these initial measures are ineffective, there would be no long term control option.

The No Action alternative proposes no long term control strategy to address treatment of newly discovered invasive plant populations or to arrest the spread of established invasive plant populations. This could have a lasting negative impact upon tribal Trust resources.

3.12.1.2. Alternative 2 – Current Action

Direct and Indirect Effects

The effects of Current Action alternative activities would be visible during and immediately after treatments. Visible consequences may include instances where dye is readily visible or where vegetation is wilted or dead. Where methods such as pulling are utilized, there may be some level of noticeable surface or soil disturbance. These visual impacts would be short term (generally 1-7 days), and generally minor in nature. During the period that physical treatment of invasive plants is occurring there may be some level of disturbance or visual distraction created by the presence of work crews. This may be disconcerting to tribal elders and tribal members as they attempt to exercise their Treaty rights. However, the effect would be minor and of short duration.

3.12.1.3. Alternative 3 – Proposed Action

Direct and Indirect Effects

Under the Proposed Action alternative, the existing populations of invasive plants can be expected to increase in cover and to spread over time, but at a slower rate than under Alternatives 1 and 2. The direct and indirect benefits of the Proposed Action on Indian Trust Assets include those benefits described in the vegetation, aquatic, and wildlife resources section of this chapter that would result

from the aggressive treatment and reduction in acres of invasive plants across the SCNF. A variety of terrestrial and aquatic plants and animals, including sensitive special status species and their habitats, would benefit. Minimal or no adverse impacts to aquatic and wildlife habitat or species would be expected. During invasive plant treatment, access to some Trust Assets may be limited for a short time. The Proposed Action may have some adverse impacts on Indian Trust Assets. There may be short-term adverse effects on Trust Assets from herbicide odor and drift to non-target areas during aerial spraying. Other adverse, short-term effects may stem from chemical odors and drift as ground-based herbicides are applied. Noise, dust, and trampling from mechanical treatments may also have a short term effect on Trust Assets. Individual non-target plants could be inadvertently killed during treatment. Access for the cultural gathering of plants may be affected, but only for a short time as invasive plant treatment is implemented and briefly thereafter.

3.12.1.4. Alternative 4 – No Aerial Herbicide Application

Direct and Indirect Effects

The No Aerial Herbicide Application alternative can be expected to have similar direct and indirect effects as the Proposed Action. The direct and indirect benefits of the No Action Alternative on Indian Trust Assets include those benefits described in the vegetation, aquatic, and wildlife resources section of this chapter that would result from the aggressive treatment and reduction in acres of invasive plants across the SCNF. A variety of terrestrial and aquatic plants and animals, including sensitive special status species and their habitats, would benefit. Minimal or no adverse impacts to aquatic and wildlife habitat or species would be expected. During invasive plant treatment, access to some Trust Assets may be limited for a short time. There may be short-term adverse effects on Trust Assets from herbicide odor and drift to non-target areas during aerial spraying. Other adverse, short-term effects may stem from chemical odors and drift as ground-based herbicides are applied. Noise, dust, and trampling from mechanical treatments may also have a short term effect on Trust Assets. Individual non-target plants could be inadvertently killed during treatment. Access for the cultural gathering of plants may be affected, but only for a short time as invasive plant treatment is implemented and briefly thereafter

Under the No Aerial Herbicide Application alternative, the existing populations of invasive plants can be expected to increase in cover and to spread over time, but at a slower rate than under Alternative 1 (No Action) or Alternative 2 (Current Action). Because aerial application is not an option under this alternative it would not be as effective as Alternative3 (Proposed Action) in addressing infestations that are not as easily accessed by conventional means. The primary consideration within this context is the effect that invasive plant populations have upon wildlife and fish species, notably the potential for a reduction in population or relocation of existing populations. This can affect historic use patterns of wildlife and, consequently, the quality of experience for tribal members attempting to exercise their Treaty rights.

3.12.1.5. Alternative 5 – No Aquatic Herbicide Application

Direct and Indirect Effects

Under the No Aquatic Herbicide Application alternative, the existing populations of invasive plants found in and near high use water-based tribal fishing and gathering areas and in the river and stream corridors can be expected to increase in cover and to spread over time, but at a slower rate

than under 1. Because aquatic application is not an option under this alternative it would not be as effective as Alternative3 in addressing high risk areas near water. The primary consideration within this context is the effect that invasive plant populations have upon wildlife and fish species, notably the potential for a reduction in population or relocation of existing populations. This can affect historic use patterns of wildlife and, consequently, the quality of experience for tribal members attempting to exercise their Treaty rights.

Cumulative Effects For All Action Alternatives

The effects to the tribal Trust resources associated with invasive plant treatments under all action alternatives in conjunction with any reasonably foreseeable future activities are short term. It is unlikely that continued treatment activities would occur over a wide range of tribal Trust resource gathering areas simultaneously so although some displacement of users may occasionally cause inconvenience, this is not a significant concern.

It is anticipated that all future ground disturbing activities would be developed with project specific preventative control measures. This should allow the Forest to minimize the impact of future management actions on the introduction or spread of invasive plants. This would minimize the effect of future activities on tribal Trust resources.

3.13. Rangeland Resources

3.13.1. Introduction

This section describes the effected environment and analyzes the potential for effects to range resources resulting from implementation of the proposed project and alternatives both from the impacts of invasive plants and the impacts of invasive plant control. This includes treatment of invasive plants using herbicides, mechanical methods and biological control agents.

3.13.2. Measurement Indicators

The approach for this resource would analyze the effects of the alternatives on grazing allotment permittees and range resources. The unit of measure is the change in availability and quality of forage resources for grazing attributed to invasive plant management in consideration of the following and other appropriate factors:

- Changes in livestock movement patterns that require additional labor or may reduce the availability and quality of grazing resources for certain allotments.
- Alterations to season of use (length, turn-out, turn-off, etc.) and intensity of use that could reduce outputs and could include resting of pastures resulting in reduction of livestock use and output.

3.13.3. Compliance with Forest Plan and Other Relevant Direction

Challis LRMP

Forest Management Goals

- Manage all allotments to maintain suitable range in satisfactory (rangeland which is in an ecological state of fair or better and with an upward or stable trend) condition, and improve suitable range that is in less than satisfactory condition.
- Maintain noxious weed control program at or above current level.
  Objective 1: Update noxious weed infestation map and control plan annually in conformance with the integrated pest management policy. Continue modest investment in noxious weed and poisonous plant control. Emphasize education and information programs for persons who use herbicides or pesticides on the Challis National Forest.
- Maintain or provide for increase in livestock grazing to maintain local ranching economy.
- Provide adequate forage/space and suitable displacement areas for elk

Forest-Wide Management Direction, Standards and Guidelines

- Utilize grazing systems on allotments which provide for deferment of rest whenever possible. Season-long grazing or common use will be allowed only where resources can sustain such use.
- Allotment management plans will identify and schedule forage improvement opportunities and structural improvement needs.
- Allotments with unsatisfactory range conditions and/or need management systems will receive funding priority for range improvement needs.
- Develop and maintain a coordinated program for control of selected noxious farm weeds.
- New infestations and areas where noxious farm weeds are spreading will receive first priority for treatment.
- Require permittees' cooperation and participation in the range improvement program, to achieve and maintain AUM output.
- Use coordinated resource management planning and Stewardship concept in management and development of AMP's.
- Manage allotments according to approved management plans. Revise and update AMP's based on inventory information as needed to resolve resource conflicts and reflect management direction contained in this Plan.
- Defer livestock grazing on range and wildlife habitat improvement project areas for a sufficient period of time, following treatment, to allow for proper vegetation response.
- All project soil-disturbing activities will be mitigated and revegetated to prevent soil erosion and occupancy of site by undesirable vegetation. Activities that create or provide for the establishment of noxious weeds will be required to provide for their control.
- Machine application of herbicide in the treatment of vegetation will not be permitted in riparian areas or where it might contaminate water courses or impact riparian vegetation.

Salmon LRMP

- Provide for the grazing of livestock at slightly increased levels on selected allotments.
- Manage all allotments to maintain suitable rangelands that are presently in satisfactory condition, and improve suitable rangelands that are in poor or fair condition.
- Control noxious weeds as needed to protect the value of other resources and comply with State law.

Forest-wide Management Direction, Standards and Guidelines

- Produce National Forest portion of needed range forage by effectively developing National Forest System ranges to their reasonably attainable potential.
- Improve and maintain environmental quality of NFS ranges by managing the grazing in harmony with the needs of other resources and their uses.
- Contribute to the maintenance of viable rural economics by promoting stability of family ranches and farms.
- Optimize the production and use of forage on all suitable range to the extent it is cost-effective.
- Make maximum use of a coordinated planning approach in developing all allotment management plans to better integrate improved management of National Forests, associated public lands and privately owned lands.
- Search out and apply techniques to resolve livestock grazing problems or conflicts with other resource uses within riparian areas.
- Coordinate range improvement and management activities with wildlife habitat needs, especially on key habitat areas such as winter ranges, calving areas, riparian areas, and sage grouse leks.
- Shift livestock grazing from lands in deteriorated condition where neither management nor treatment will result in improvement.
    a. Certain standards and guidelines apply to all National Forest System lands which are grazed by domestic livestock. Existing laws, regulations, and Forest Service policy will apply to all grazing management activities on the Salmon National Forest.

In addition the following standards and guidelines will be applied on the Salmon National Forest:

- Revegetation and cultural treatments.
    a. Protect treated areas from grazing for a minimum of two growing seasons following treatments.
    b. Perform Order 2 soil surveys on all revegetation projects involving mechanical site preparation which substantially alters the A-horizon soil profile.
    c. Sites in less than satisfactory condition with high production potential will receive priority consideration in scheduling cultural treatments.
- Where practical stock driveways and trailing routes will be located outside of riparian zones
- Treat noxious farm weeds in the following priority:
    a. Leafy spurge and Russian and spotted knapweed, yellow star thistle, and musk thistle;
    b. Invasion of new plant species classified as noxious farm weed

c. Infestation in new areas;
d. Expansion of existing infestations of Canada thistle and other noxious farm weeds;
e. Reduce acreage of current infestation.

- Prohibit trailing of livestock along the length of riparian areas except where existing stock driveways occur. Rehabilitate existing stock driveways where damage is occurring in riparian areas. Relocate them outside riparian areas if possible and if necessary to achieve riparian area goals.

Objectives

- Complete approximately 60 acres of noxious weed control treatments annually. Initiate management activities to improve the condition of riparian areas in those allotment plans where riparian ecosystems are currently in a degraded condition

In addition, the following standards and guidelines will be applied on the Salmon National Forest:

In addition to the LRMPs, the project follows guidance under the Interim Strategies for Managing Anadromous Fish-producing Watersheds in Eastern Oregon and Washington, Idaho, and Portions of California (PACFISH) and INFISH. The following grazing management practices are:

GM-1 Modify grazing practices (e.g., accessibility of riparian areas to livestock, length of grazing season, stocking levels, timing of grazing, etc.) that retard or prevent attainment of Riparian Management Objectives (RMOs) or are likely to adversely affect listed anadromous fish or native fish species. Suspend grazing if adjusting practices is not effective in meeting RMOs and avoiding adverse effects on listed anadromous fish (PACFISH) or inland native fish (INFISH).

GM-2 Locate new livestock handling and/or management facilities outside of Riparian Habitat Conservation Areas (RHCAs). For existing livestock handling facilities inside the RHCAs, assure that facilities do not prevent attainment of RMOs or adversely affect listed anadromous fish (PACFISH) or inland native fish (INFISH). Relocate or close facilities where these objectives cannot be met.

GM-3 Limit livestock trailing, bedding, watering, salting, loading and other handling efforts to those areas and times that will not retard or prevent attainment of RMOs or adversely affect anadromous fish (PACFISH) or inland native fish (INFISH).

RA-3 Apply herbicides, pesticides, and other toxicants, and other chemicals in a manner that does not retard or prevent attainment of RMOs and avoids adverse effects on listed anadromous fish (PACFISH) and inland native fish (INFISH).

Desired Conditions

The Challis and Salmon Forest Plans identified the desired condition for range resources and related problems associated with “noxious farm weeds” with the time frames of immediate needs and actions as well as those projected to occur over the intended life of the Plans of 10 to 15 years. These desired conditions with regard to noxious weeds are current and in line with other regulatory direction such as, Executive Order 13112 of 1999 issued “to prevent the introduction of invasive species and provide for their control and to minimize the economic, ecological, and human health

impacts that invasive species cause", and Title 22, Idaho Code, Noxious Weeds Law for the State of Idaho.

3.13.4. Methodology for Analysis

Analysis of the effects of proposed and alternative treatments of invasive plants species and on range resources is focused on forage assets available for grazing use by domestic livestock on Forest grazing allotments. Evaluation of infestation areas and potential/susceptible sites/landscapes in conjunction with projected changes related to alternatives is the primary means of impact assessment and comparison.

Analysis Assumptions:

- Livestock would not be directly exposed to chemical applications for treatment of invasive plants whether ground or aerial delivery
- Incidental exposure of livestock to treatment chemicals through forage consumption and water intake would be taken into consideration and label restrictions applied for subsequent handling/processing of animals for the food supply (Appendix R).

Analysis Area

The analysis area for consideration of direct and indirect effects is the non-wilderness portion of the SCNF. The analysis area for consideration of cumulative effects encompasses all land ownerships (private, state and other federal lands) within the Upper Salmon River, Little Lost River and Big Lost River Basins. See Map 1

Spatial and Temporal Boundaries

As required in 36 CFR 220.4(f) the analysis considers the present effects of past activities. These effects are reflected in the existing condition in following sections of this report. The spatial boundaries for analyzing the cumulative effects to the range resource were all land ownerships in the three river basins listed above because of their juxtaposition and interdependence related to invasive plant species occurrence on the landscape.

In addition, the analysis considers the temporal effects of the activities – that is how long would the effects of the action alternative last. The time frame of the analyses includes the past 20 years and the next 15 years which is expected to be the life expectancy of this document. Even though invasive plant species have been present on the Forest prior to the past 20 years, and have subsequently spread, the Salmon and Challis National Forests Land and Resource Management Plans (Forest Plans) from the late 1980s did not fully identify problems caused by these plants. Ecologically their impacts were not widely recognized.

3.13.5. Affected Environment

Presently 76 percent of the Salmon-Challis National Forest (excluding wilderness) is appropriated into range allotments (2,367,639 acres, based on GIS data layers located at the Salmon-Challis National Forest Supervisors Office). There are 120 allotments (designated active, vacant, and closed) in which 80 percent of the noxious weed species sites (3169 of the 3951) are located. Twenty six of these 120 allotments (22 %) are uninfested by noxious weeds according to current inventories.

These sites located on grazing allotments represent approximately 71 percent of the infested acres forest wide (34,787 acres of the total 49,153 infested acres across the Forest) Table 3-73 and Table 3-74.

Table 3-73: Noxious Weed Species Acres in Salmon-Challis National Forest Grazing Allotments

Noxious Weed Species[1]	Estimates of Total Acres infested within Allotments[2]	Estimated Total Acres infested on Salmon-Challis National Forest
Russian Knapweed	0.1	0.2
Hoary Alyssum	1,545.0	2,176.4
Whitetop	49.8	49.8
Musk thistle	1,726.2	1,782.2
Diffuse Knapweed	4.2	4.5
Spotted Knapweed	26,349.3	39,205.2
Rush Skeletonweed	111.3	345.6
Oxeye Daisy	119.7	218.7
Canada Thistle	2,623.0	2,642.3
Field Bindweed	0.2	0.6
Houndstongue	746.2	795.1
Leafy Spurge	825.7	865.2
Black Henbane	283.5	284.4
Common St. Johnswort	0.0	2.5
Dyer's Woad	0.0	0.0

(Salmon-Challis National Forest Geographical Information System (GIS) database 02/14)
1 For Scientific names see Species Codes below
2 Multiple species can occur on a site therefore some overlap in total gross acres may occur
These acreages are gross acres where areas are delineated by the outer perimeter of the weed infestation and may contain significant areas that are not currently occupied by weeds.

Table 3-74: Noxious weed acres presently identified within each allotment type outside FC-RONR Wilderness

Allotment Status/Use	Allotment acres (National Forest System lands / (Number of Allotments)	Noxious weed species acres	Number of Noxious Weed Species Sites	Number of Noxious Weed Species Present within Allotment	Percent of Allotment acreage occupied by Noxious Weeds	Percent of Total Forest Land base infested with Noxious Weeds
Active	2,117,429 / (102)	28,580	2,744	11	1.346 %	0.914 %
Closed	6,202 / (1)	13	25	6	0.213 %	0.0 %
Vacant	244,008 / (17)	6,194	400	9	2.537 %	0.198 %
Total	2,367,639 / (120)	34,787	3,169	11	1.466 %	1.113 %

For a complete listing of allotment acres and individual noxious weed species acreage within each allotment see Appendix S.

Spotted knapweed, Canada thistle, musk thistle, hoary alyssum and leafy spurge are noxious weed species that are most prevalent in the allotments and landscape in general forest wide (Table 3-73). These five species account for 79% of the sites and 95% of the acreage of noxious weed infestation on grazing allotments. The northern end of the forest has most of these acreage and sites within the North and Salmon Invasive plant Management Zones. In combination, these two zones contain 65% of sites and 76 % of acreage of infestations on allotments.

Table 3-75: Noxious Weed Species Infestations on Forest Grazing Allotments by Invasive Plant Management Zones

Invasive Plant Management Zone	Number of Allotments	Noxious Weed Species Sites	Percentage of Infestation Sites	Noxious Weed Species Acres	Percentage of Infestation Acres
Lemhi Zone	32	560	17	2,805	8
North Zone	6	826	26	12,144	35
Pahsimeroi-Lost Zone	50	441	14	4,132	12
Salmon Zone	17	1,216	39	14,386	41
Upper Salmon Zone	15	126	4	1,320	4
Total	120	3,169	100	34,787	100

Information displayed in Table 3-75 above by Invasive plant Management Zones includes data about the following grazing allotments with prevalent infestations:

- In the North Zone there are Burns Basin, Indian Ridge and Sage Creek allotments north of the Salmon River canyon on the North Fork Ranger District
- South of the river canyon in the Salmon Zone on the Salmon-Cobalt Ranger District there is Clear Creek-Panther Creek (vacant), Williams Basin-Napias Creek, Diamond-Moose and Prairie Basin portion of the Morgan Creek allotments.

Spotted knapweed makes up about 85% of the infested acres on these allotments with the next most common noxious weed species of hoary alyssum at 6%.

3.13.5.1. Summary of Existing Conditions

In summary less than 1.5% of the forest area and inclusive grazing allotments contain infestations of noxious weeds which indicate that the analysis (project) area is dominated by native and desirable plant communities functioning within intact ecosystems (Vegetation Specialist Report, 2014). Noxious weed species are unevenly distributed and occur in varying number (up to 11 species) and acreage (up to 5,200 acres) on allotments across the Forest, while only 78% of allotments have inventoried infestations. Twenty nine percent of noxious weed infestations forest wide occurs on lands outside of designated allotments. Spotted knapweed is the most prevalent weed species across all zones, accounting for almost 75% of all noxious weed acreage within grazing allotments.

Allotments and grazing areas on the north end of the Forest adjoining the Salmon River canyon and its larger tributaries like North Fork and Panther Creek are the most problematic from the perspective of noxious weed infestations. This situation stems from the existence and extent of infestation currently present on parts of the landscape that coincide with the primary livestock grazing areas of grazing allotments in these areas. Grassland, grass/shrub and low elevation dry forest cover types that are suited to grazing use are the sites of most infestations due to past

invasive plant introductions and disturbances from roads, livestock and wildlife grazing, timber harvest and other natural events such as drought and recent wildfires. These conditions and disturbance factors, with the possible exception of timber harvest, are expected to continue which presents the situation of the primary livestock grazing areas on allotments being highly vulnerable to invasive plant invasion. Past and current invasive plant species management efforts by the Salmon-Challis National Forest and Federal, State, county agencies and cooperators along with private entities have had limited success and effectiveness in eradication, control or suppression of establishment and spread of invasive plants.

3.13.5.2. Grazing Resources on the Forest

The Challis Forest Plan recognized that demand for cattle use exceeds the supply while acknowledging that overall range conditions and productivity had improved substantially since pre-1940's when management controls were limited. Grazing trends on the Forest after the 1970's showed decreased use from earlier periods which also contributed to range recovery and gradual increases in livestock use at the time the Plan was completed (1987). The Plan outlined goals to manage allotments to maintain or improve conditions to satisfactory levels, to maintain invasive plant control program at or above current level, and maintain or provide for increase in livestock grazing to maintain local ranching economy.

Grazing and range resource demand analyzed in the Salmon Forest Plan disclosed that loss of this use on the Forest would result in 46% of livestock operation with Forest Service permits becoming uneconomical with an additional 40% becoming severely impacted. Due to the 8% private land base in Lemhi County the opportunities to expand base properties of livestock operations are very limited. Likewise the Plan acknowledge limited opportunities for increased grazing capacity on National Forest System lands based on grazing management system changes or range improvement projects. These factors outline the importance in maintaining the ability of Forest grazing allotments to contribute to the goal of maintenance of viable rural economies by promoting stability of family ranches and farms.

3.13.6. Environmental Consequences

This section will present the direct, indirect and cumulative effects analysis for range resources. Issues and effects related to range resources will be presented by No Action alternative and grouping of the four action alternatives.

A number of comments received during the scoping process suggested that the Forest Service consider prohibiting major land-use activities on National Forests that are associated with invasive plant spread including the elimination of livestock grazing. Elimination of these multiple-use activities is outside the scope of this EIS and is inconsistent with current laws governing the management of National Forest System lands. The action being considered is whether to treat invasive plant species and if so to what degree.

3.13.6.1 Alternative 1-No Action

This alternative is required by regulation (40 Code of Federal Regulations (CFR) 1502.14). No invasive plant management treatments would be applied to any non-wilderness National Forest System (NFS) lands. The alternative provides a baseline for comparison and analysis of effects.

There would be no herbicide application (ground based or aerial application), mechanical methods (hand or tool grubbing, mowing), revegetation, or biological control. Existing biological controls would be allowed to progress naturally, but no supplementation would occur. Ongoing invasive plant prevention and education would still continue, but additional measures would not.

Direct and Indirect Effects

Existing invasive plant infestations would persist, new infestations would establish and new invaders would arrive. The No Action alternative would contribute to increases in invasive plants in terms of number, size and density of infestations. New invaders (i.e. species that do not currently occur on SCNF) could become common and widespread if they were introduced onto lands on the Forest. Eventually, existing and new invasive plants could colonize and occupy all suitable habitats. The cessation of detection and rapid response efforts could result in the establishment and spread of new invasive plant species and new infestations.

Native plants become stressed from the additional competition imposed by invasive plants. The percentage of native vegetation occupying a site would decline as invasive plant density increased. Eventually, there would be a loss of native plant diversity as more and more native species are eliminated from the community. Palatable and nutritious native grasses and forbs are replaced with invasive plant species that do not provide necessary nutrition and which may not be palatable, reducing forage values for livestock and many species of wildlife. These changes in native plant community composition and structure can have severe impacts on livestock carrying capacity by altering forage availability, and also reducing forage, cover and habitat for wildlife populations. (See the Vegetation and Wildlife Specialist Reports, 2014). Inevitably, there would be changes in fire regime and other natural disturbance processes as invasive plants alter natural successional stages. The north end of the Forest where spotted knapweed infestations are prevalent would be particularly impacted due this invasive plant plant's allelopathogenic properties and potential for developing large monocultures in favorable locations.

The increase in acreage infested with very difficult to control rhizomatous species such as leafy spurge would result in permanent establishment of these species (Vegetation Specialist Report, 2014). Increases in species with seeds that cling to clothing, equipment or animal fur, such as hounds tongue, would result in seeds being transported far more widely and establishing in new areas.

Toxic and irritant species such as Canada thistle and leafy spurge would continue to increase under the No Action alternative. Most of the Canada thistle is along roadsides and grazing animals would likely avoid these areas in search of more palatable forage elsewhere. Leafy spurge is present in small to medium sized spots (<10 acre areas) and several larger patches (50-200 acres) located in 30 allotments forest wide totaling 825 acres. Due to the scattered nature of these infestations, it is likely cattle would avoid these areas and no direct impacts to cattle from toxic/irritant properties from either of these two species would occur with this alternative. Indirect effects would be reduced native forage and grazing area available for livestock use at the location of infestations because of animal avoidance.

Cumulative Effects

Cumulative impacts to the range resource and agricultural economy would be expected to occur with the No Action alternative. Reduced or lost grazing opportunities on forest allotments may

result in operational costs to permittees and/or other agricultural enterprises that would in turn loose economic viability. Cost would increase and effectiveness decrease for invasive plant species treatment on adjoining governmental and private lands within local communities and the river basins outlined for cumulative effects analysis because of new invasion or re-invasion potential.

Agriculture industry and associated ranching in communities encompassed by the SCNF have already incurred increased costs because of invasive plant control efforts on private and other jurisdiction lands. Added to this are recent requirements and expenses for water diversion and irrigation modifications and reduced/restricted public land grazing to address resource issues with multiple fish listings under the Endangered Species Act. Conservation and protection measures anticipated in the near future for habitats for sage-grouse, a candidate for ESA listing, throughout its range in the west would likely require management adjustments on Forest grazing allotments. In the SCNF this could equate to reduced grazing use on allotments with habitat for this species primarily located on the south end of the Forest. Communities within the SCNF with a high percentage of employment tied to agriculture, such as Tendoy, Leadore, Pahsimeroi valley and Mackay, would potentially incur losses in this segment of their economies.

Changes in landscape fire regime and climate factors that influence the frequency and severity of wildfires on the Forest have resulted in large acreages that have burned in the last 15 years with prospects of a continuation of this pattern. While wildfires may improve forage conditions on allotments in the short term, the likelihood of invasive plant species infestation expansion and new infestation from invasive plants such as cheatgrass (*Bromus tectorum*) are possible undesirable results. Post-fire rest of burned grazing areas on allotments for two growing seasons to allow plant recovery, required in many cases by the SCNF, is an additional adverse impact to permittees and their allotment operations.

An actual reduction in head months (HMs) of grazing use attributed to invasive plant management cannot be quantified at the project scale due to unavailable data, variability between allotments, and the ongoing process of Allotment Management Plan revision.

No Action Summary and Conclusions

The No Action alternative does not comply with legal requirements or with Forest Service national and regional direction on the management of non-native invasive plants species. Neither does it contribute to attainment of the desired condition for range resources in the project area.

In conclusion, ending all invasive plant management practices on SCNF could result in an unchecked expansion of invasive plants until all vulnerable habitats were occupied by invasive plants. The spread of invasive plant species would lead to a cascading set of ecosystem impacts. These would include, but are not limited to, deleterious effects such as loss of watershed function and ecosystem services, reduced soil stability and water holding capacity, loss of wildlife habitats, and loss of grazing allotment capability to provide native forage to support local livestock operations. Accessible grazing areas that can support sufficient livestock numbers for a length of season matching the companion base of the ranching enterprise would be a commodity and economic value at risk as a result of No Action. Allotments on the north end of the Forest are the most at risk from no treatment/action due to the extent and degree of existing invasive plant species infestations already present. Allotments on the south end of the Forest would likely be impacted to

a greater degree as invasive plant species infestations increased when added to reduced grazing opportunities anticipated to occur due to sage-grouse habitat conservation requirements.

Significant negative cumulative impact to rangeland resources and local agricultural economy are anticipated to occur based on degradation and loss of forage resources on allotments, especially on the north end of the Forest. Current resource protection measures that reduce grazing such as stream protection, endangered species management, periods of burned area rest for vegetation recovery in combination with forage loss due to competition from invasive plant species would likely result in the economic failure of some ranching/farming operations in the Salmon and Lemhi River valleys and economic hardships to Custer and Butte County ranches.

Environmental Consequences Summary for No Action by Issue Indicators:

- Changes in livestock movement patterns that require additional labor or may reduce the availability and quality of grazing resources for certain allotments:
- Quantity and quality of forage resources would decrease and degrade on grazing sites as invasive plant density increased. Operational costs to permittees and/or other agricultural enterprises would increase and in some cases to levels that are not sustainable.
- Alterations to season of use (length, turn-out, turn-off, etc.) and intensity of use that could reduce outputs and could include resting of pastures resulting in reduction of livestock use and output:
- Shorter grazing seasons, fewer livestock numbers and further restrictive forage use standards would likely result from unchecked expansion of invasive plant infestations. Decreased livestock performance and weight gains associated with this would limit the viability of future grazing of some Forest allotments.

3.13.6.2. Alternative 2-Current Action

Direct and Indirect Effects

Invasive plants are currently damaging the ecological integrity of lands within and outside these allotments. Under the Current Action alternative invasive plants have the potential to continue to displace palatable native vegetation and could reduce forage on grazing allotments. Activities within allotments would continue to serve as seed dispersal vectors as these invasive plants sites continue to grow. As described in the treatment effectiveness section of the Vegetation Specialist Report (2014), loss of native plant communities may continue to occur as invasive plants occupy and out-compete native species. Once invasive plant species begin to dominate these communities, a loss of species diversity, composition, and ecosystem function could occur. Established noxious invasive plants would likely serve as seed sources for other areas of the Forest and nearby or adjacent other Federal, State or private lands.

The acreage amount and extent of treatment by biological, mechanical, herbicide and cultural methods prescribed under the Current Action alternative would not be adequate to contain the continued spread of some weed species into areas that are not currently infested. Noxious weed species would continue to spread as documented from past inventories compared to the current inventories. Spotted knapweed plant infestations on the north end of the Forest for example already escape effective treatment due to distribution abundance, lack of funding for control, and

access difficulty for ground application of herbicides. invasive plant density may also be lesser than optimum for biological control methods to be an effective consideration.

Impacts from control of invasive plants to native plant communities are expected to be minor. Native species' abundance, diversity and distribution in the SCNF are robust whereas invasive plant cover is generally low and only spot treatment is the preferred herbicide application method. While non-target vegetation can be affected by invasive plant control activities, loss or abundance of native plants used by livestock because of control treatments would not be of the magnitude to influence normal grazing practices or usage of foraging areas. Mechanical and cultural activities would potentially have effects to other vegetation of very limited scale and could result in the need for post-treatment grazing avoidance of small areas for a short recovery period.

No operational changes for permittees/livestock managers would be anticipated beyond current practices on allotments when invasive plant species control treatments occur concurrent with livestock presence. Some grazing permittees may choose to avoid areas during active treatment. Conflicts can be circumvented by pre-season development of Annual Operating Instructions with the SCNF. Observance of herbicide label directions regarding livestock bound for other pasture and/or processing/slaughter (Appendix S) would avoid impacts to operations due to handling or marketing changes.

Ultimately, invasive plant species prevention and control practices under the Current Action alternative may result in some reduction to livestock grazing due to its inadequacy in addressing the scope and changing extent of the invasive plant problem in the SCNF.

The actual reduction in Head Months (HMs) of grazing use attributed to invasive plant species management cannot be quantified at the project scale due to unavailable data, variability between allotments, and the ongoing process of Allotment Management Plan revision

Cumulative Effects

Cumulative impacts to the range resource and agricultural economy would be expected to occur with the Current Action alternative. Similar to the discussion in the No Action alternative, reduced or lost grazing opportunities on Forest allotments may result in operational costs to permittees and/or other agricultural enterprises that would in turn loose economic viability. Past management activities in the SCNF in combination with the conservative approach to controlling invasive plants has resulted in an increase in infested acres and impacts to ecosystem integrity.

Various activities incorporated in the list for Cumulative Effects Considerations (Appendix H) were included in this analysis for the Current Action alternative. Recreational use, road construction and use, fire and its associated management activities, timber and natural fuels management activities, grazing, and climatic events such as drought are all documented to have contributed to invasive plant species establishment and spread. The true impacts of recent large wildfires on the Forest, especially the 2012 Mustang Complex, have not been fully recognized. Invasive plant spread at the expense of livestock forage and likely restrictions of grazing use due to upcoming conservation requirements for sage-grouse habitat are factors likely to diminish the productivity of the range resource and its use on SCNF allotments. The conservative approach of the Current Action alternative when added to these conditions and trends would not be adequate to sustain current grazing use and economic value to local agriculture.

Current Action Summary and Conclusions

The Current Action alternative does not meet legal requirements nor comply with Forest Service national and regional direction on the management of non-native invasive plants species. Neither does it contribute to attainment of the desired condition for range resources in the project area. The Current Action alternative would have only limited success in minimizing the spread of invasive plants. Based on effectiveness monitoring in the SCNF this alternative would fall short in the long term of providing a reduction in the density of existing invasive plant populations within currently infested native plant communities, and containment of spread of invasive plant seed from these populations to un-infested areas around the SCNF.

Current resource protection measures that reduce grazing such as stream protection, endangered species management, periods of burned area rest for vegetation recovery in combination with forage loss due to competition from invasive plant species would likely result in the economic hardship to some permittees and their ranching/farming operations in Lemhi, Custer and Butte Counties.

Environmental Consequences Summary Alternative 2 by Issue Indicator

- Changes in livestock movement patterns that require additional labor or may reduce the availability and quality of grazing resources for certain allotments:
- Quantity and quality of forage resources would potentially be maintained on some but not all grazing sites as invasive plant density increased and infestation expand. Operational costs to permittees and/or other agricultural enterprises would increase over current levels, potentially causing economic complications. The Current Action alternative would not sustain rangeland resources essential for the use of Forest grazing allotments over the long term.
- Alterations to season of use (length, turn-on, turn-off, etc.) and intensity of use that could reduce outputs and could include resting of pastures resulting in reduction of livestock use and output.

The Current Action alternative would potentially fail to check expansion of noxious weed infestations and result in restrictive forage use standards, eventual reduction of existing grazing seasons, and livestock numbers. Other factors such as sage-grouse ESA listing and subsequent conservation requirements/practices are elements potentially causing these alterations to occur sooner or with greater effect.

3.13.6.3. Alternative 3-Proposed Action

Direct and Indirect Effects

The acreage amount and extent of treatment by biological, mechanical, herbicide and cultural methods prescribed under the Proposed Action alternative would be sufficient to control existing infestations and contain the continued spread of some invasive plant species into areas that are not currently infested. The aggressive IWM approach of this alternative would maintain and eventually recover the native plant community composition in areas currently impacted by noxious weed species. Long-term effects of invasive plant treatments in the SCNF would be the retention of currently available forage that has palatable and nutritious native grasses and forbs of essential value to livestock and many species of wildlife. Healthy, quality native forage is necessary for the

continued grazing use of Forest allotments which in turn supports the viability of ranching and agriculture operations and the economies of local communities. Operative invasive plant management on the Forest would complement and increase effectiveness of control efforts on adjacent Federal, State or private lands.

Impacts from control of invasive plants to native plant communities are expected to be minor even with increased herbicide use with ground and aerial applications. Native species' abundance, diversity and distribution in the SCNF are robust whereas invasive plant cover is generally low and only spot treatment is the preferred herbicide application method. While non-target vegetation can be affected by invasive plant control activities, loss or abundance of native plants used by livestock because of control treatments would not be of the magnitude to influence normal grazing practices or usage of foraging areas.

No adverse effects to large mammals was found from direct spray of herbicides that could be applied aerially even at the highest expected rates (See Wildlife Report, 2014), and only typical application rates are proposed for aerial application of herbicides (See Proposed Action alternative description above). Most aerial sites are located in steep terrain with limited access areas where livestock generally do not prefer; however, DC's would provide additional protection in the event stay grazing animals were present in areas

Some herbicides have label use restrictions that would be followed with reference to livestock grazing and/or slaughtering (Appendix R) post herbicide treatment and subsequent exposure. Treating pastures that are currently in rest due to grazing management rotations would eliminate any potential effects. If movement of livestock is not possible and pastures or allotments require treatment while animals are present all label use restrictions would be followed in addition to design criteria that require permittee notification prior to any proposed aerial application. In addition, timely notification and coordination should occur during annual operating instruction/plan meetings. For aerial herbicide application within allotments, permittees would be notified of proposed expected timeframes for treatment to allow the option to remove animals.

No direct or indirect effects are expected to range resources or livestock operations from the potential treatment of 1,223 susceptible acres of water bodies if infested.

Rehabilitation and Restoration activities conducted on allotments with this alternative could require protection of the treatment areas from grazing for a period of time to allow action affect and recovery of the target plant communities. Grazing schedule changes and short-term livestock exclusion measures (i.e., temporary fencing) may be necessary to assure success. Permittees would possibly incur expense for labor costs associated with this management adjustment. Many of the grazing strategies within allotments have deferred rotations and by focusing invasive plant treatments to the pastures during the resting phase would avoid most all potential impacts to permittees.

Cumulative Effects

Cumulative effects are expected to be positive for the Proposed Action alternative because more aggressive treatments in its Biological, Manual and Mechanical, Herbicide and Rehabilitation and Restoration features combined with Early Detection Rapid Response activities and cooperative efforts with other federal, state and private landowners would reduce the potential for additional spread and loss of available forage.

Cumulative impacts to the range resource and agricultural economy would be expected to be avoided to an extent with the Proposed Action alternative. Grazing opportunities maintained or enhanced in Forest allotments may result in reduced operational costs to permittees and/or other agricultural enterprises that would in turn support their economic viability. This alternative would be expected to contribute to healthy, intact range ecosystems that are more likely to withstand and recover from disturbances such as large landscape scale wildfires characteristic of current fire regimes.

Various activities incorporated –in the list for Cumulative Effects Considerations (Appendix H) were included in this analysis for the Proposed Action alternative. Recreational use, road construction and use, fire and its associated management activities, timber and natural fuels management activities, grazing, and climatic events such as drought are all documented to have contributed to invasive plant species establishment and spread. The true impacts of recent large wildfires on the forest, especially the 2012 Mustang Complex, have not been fully recognized. Invasive plant spread at the expense of livestock forage and likely restrictions of grazing use due to upcoming conservation requirements for sage-grouse habitat are factors likely to diminish the productivity of the range resource and its use on SCNF allotments. The aggressive approach of the Proposed Action alternative would potentially counter these conditions and trends and help sustain current grazing use and economic value to local agriculture.

Alternative 3 Summary and Conclusions

The Proposed Action alternative addresses problems posed by invasive plant species that compromise management of native ecosystems in the SCNF. The need to reduce the extent of current invasive plant infestations and to protect uninfested areas through early detection rapid response from future establishment would likely be met by this alternative. As invasive plant sites are controlled, eradicated, suppressed and/or contained, and EDRR treatments are applied to newly documented sites; positive effects would result from the implementation of this alternative.

Some short–term limitations on livestock grazing may occur. As implementation of the proposed action occurs, it is expected that increased retention of desirable species, vegetation density, and plant vigor of desired native vegetation would increase and/or improve.

Current resource protection measures that reduce grazing such as stream protection, endangered species management, periods of burned area rest for vegetation recovery in combination with forage improvements due to effective invasive plant species control would likely improve the economic viability to some permittees and their ranching/farming operations in Lemhi, Custer and Butte Counties.

Environmental Consequences Summary for Alternative 3 by Issue Indicators

- Changes in livestock movement patterns that require additional labor or may reduce the availability and quality of grazing resources for certain allotments:

  Quantity and quality of forage resources would potentially be maintained and/or enhanced on grazing sites as invasive plant density decreased and infestations recede. Operational costs to permittees and/or other agricultural enterprises would be supported at close to current levels, potentially avoiding economic complications. The

Proposed Action alternative would sustain rangeland resources essential for the use of Forest grazing allotments over the long term.

- Alterations to season of use (length, turn-on, turn-off, etc.) and intensity of use that could reduce outputs and could include resting of pastures resulting in reduction of livestock use and output:

  The Proposed Action alternative would potentially curtail expansion of noxious invasive plant infestations and result in maintaining forage use standards, existing grazing seasons, and permitted livestock numbers. Some elements of this alternative such as aerial herbicide application and rehabilitation/restoration actions may require or cause adjustments to livestock routing and short term grazing exclusion on small areas. These modifications to grazing operations would not result in net change to use of allotments. Other factors such as sage-grouse ESA listing and subsequent conservation requirements would not predispose the Proposed Action alternative to causing cumulative impacts to livestock use because of forage loss due to invasive plant infestations.

3.13.6.4. Alternative 4-No Aerial Herbicide Application

Direct and Indirect Effects

Under this alternative, most of the proposed aerial acres that would not be treated aerially would be treated with other methods however, may not be as effective at reducing invasive plants (see the Vegetation Specialist Report, 2014 for full description of alternative treatments proposed and areas not treated). It is expected that no impacts to forage availability would occur because the areas that would not be treated are generally in very steep terrain that most livestock would avoid.

By not aerially treating, the potential for exposure to livestock and livestock managers would be reduced. Other benefits of this alternative would be the same as Alternative 3.

Alternative 4 proposes to meet the same objectives as Alternative 3, but intends minimal impact to non-target species from drift associated with aerial treatment because no aerial application of herbicides would occur. Little impact to forage availability for livestock is expected from this alternative in that the up to 8,000 acres not treated aerially would be treated with other methods (manual ground applications). It is anticipated that these existing infestations would slowly recover to native vegetation in the future, however, the treatment method may not be as effective or recovery of vegetation may not happen as quickly as suggested in the proposed alternative. In addition as previously noted, grazing animals often do not drift into or utilize areas most commonly proposed for aerial treatment because of the steepness of slopes and general access issues, therefore, future impacts from no aerial herbicide treatments would likely have little effects.

The potential for exposure to livestock and livestock managers would be reduced in comparison to other action alternatives as less chemical would be used in areas currently proposed (and potential future sites) for aerial applications. Other than these impacts, the benefits to this alternative would be the same as the Proposed Action.

Cumulative Effect

Same as the proposed action.

Alternative 4 Summary and Conclusions

Same as the proposed action.

Environmental Consequences Summary for Alternative 4 by Issue Indicator.

- Changes in livestock movement patterns that require additional labor or may reduce the availability and quality of grazing resources for certain allotments:

  Quantity and quality of forage resources would potentially be maintained and/or enhanced on grazing sites as invasive plant density decreased and infestations recede. Operational costs to permittees and/or other agricultural enterprises would be supported at close to current levels, potentially avoiding economic complications. The No Aerial Herbicide Application alternative would sustain rangeland resources essential for the use of Forest grazing allotments over the long term.

- Alterations to season of use (length, turn-on, turn-off, etc.) and intensity of use that could reduce outputs and could include resting of pastures resulting in reduction of livestock use and output:

  The No Aerial Application would potentially curtail expansion of invasive plant infestations and result in maintaining forage use standards, existing grazing seasons, and permitted livestock numbers. Some elements of this alternative such as aerial herbicide application and rehabilitation/restoration actions may require or cause adjustments to livestock routing and short term grazing exclusion on small areas. These modifications to grazing operations would not result in net change to use of allotments. Other factors such as sage-grouse ESA listing and subsequent conservation requirements would not predispose the Proposed Action alternative to causing cumulative impacts to livestock use because of forage loss due to invasive plant infestations.

3.13.6.5. Alternative 5-No Aquatic Herbicide Application

Direct and Indirect Effects

Same as the Proposed Action. The potential treatment of 1,223 susceptible acres of water bodies if infested was not anticipated to have any direct and indirect effects to the range resource or livestock operation. Exclusion of aquatic application would have the same no effect.

Cumulative Effects

Same as the proposed action.

3.13.6.6. Alternative 5 Summary and Conclusions

Same as the proposed action.

Environmental Consequences Summary for Alternative 5 by issue indicators:

- Changes in livestock movement patterns that require additional labor or may reduce the availability and quality of grazing resources for certain allotments:

Quantity and quality of forage resources would potentially be maintained and/or enhanced on grazing sites as invasive plant density decreased and infestations recede. Operational costs to permittees and/or other agricultural enterprises would be supported at close to current levels, potentially avoiding economic complications. The No Aquatic Herbicide Application alternative would sustain rangeland resources essential for the use of forest grazing allotments over the long term.

- Alterations to season of use (length, turn-on, turn-off, etc.) and intensity of use that could reduce outputs and could include resting of pastures resulting in reduction of livestock use and output:

The No Aquatic Herbicide Application alternative would potentially curtail expansion of infestations and result in maintaining forage use standards, existing grazing seasons, and permitted livestock numbers. Some elements of this alternative such as aerial herbicide application and rehabilitation/restoration actions may require or cause adjustments to livestock routing and short term grazing exclusion on small areas. These modifications to grazing operations would not result in net change to use of allotments. Other factors such as sage-grouse ESA listing and subsequent conservation requirements would not predispose the Proposed Action alternative to causing cumulative impacts to livestock use because of forage loss due to infestations.

3.14. Air Quality

3.6.5.8. Introduction

This section describes the characteristics and relevant rules, regulations, and laws related to air quality. This section also discloses the effects that the various alternatives would have on air quality.

3.14.1. Compliance with Forest Plan and Other Relevant Direction

The basic framework for controlling air pollutants is the 1970 Clean Air Act, as amended in 1990. The primary means by which this is accomplished is through the implementation of the National Ambient Air Quality Standards (NAAQS). In addition to the NAAQS, other sections or provisions of the Clean Air Act, as amended, address general conformity, prevention of significant deterioration, and visibility (e.g. regional haze). There are no mandatory Class I airsheds, maintenance areas, or nonattainment areas within the project area, therefore elements pertaining to general conformity do not specifically apply. The analysis area and those lands immediately adjacent the project area are considered Class II airsheds (permitted moderate deterioration). Under the 1977 Clean Air Act

amendments, Congress defined mandatory Class I federal areas for wilderness areas greater than 5,000 acres, but the Frank Church – River of No Return (FC-RONR) Wilderness was designated following that effort and has not since been included as a Class I airshed (Figure 1). Table 3-77 discloses those Class I airsheds and other important areas in the larger vicinity. The goal of the Challis and Salmon LRMPs is to meet state air quality standards.

All action alternatives comply with the Challis and Salmon LRMPs and the Clean Air Act (PL 101-549).

3.14.2. Methodology for Analysis

Analysis was completed using emmissions data from the Idaho/Montana Airshed groups which measure National Ambient Air Quality Standards (NAAQS). PM-2.5. PM-10 , nitrogen dioxide, and sulfur dioxide were used as indicators.

Analysis Area

Area within the Montana/Idaho Airshed Group monitoring area- approximately 100 kilometer radius around the project area.

3.14.3. Affected Environment

This project does not propose, nor does it analyze the treatment of invasive plants within the designated Wilderness, however its long shared border with the proposed project area does have a strong influence with the project. Visibility is an important component of the wilderness experience. Currently, the predominate sources of emissions affecting visibility in the project area are outside the local area and are regional emission sources predominantly due to summer fires and coal fired plants. Local sources in the immediate area are limited and generally restricted to vehicle exhaust, smoke, and dust. Particulates from dust and smoke adversely affect visibility but these are generally short-term emission sources associated with disturbed areas related to fires and traffic on dirt roads. While generally a dryer environment, the standard visual ranges at Craters of the Moon over 100 miles south and east of the project area averaged 162 miles from 2000 to 2010. Within the Sawtooth National Recreation Area standard visual range averaged 155 miles from 2000 to 2010. Within the FC-RONR, standard visual range median values were 108 miles and 133 miles in summer and fall respectively from 1989 thru 1993. The poorest visibility (10th percentile) ranged from 55 miles to 75 miles in the summer and fall respectively during that same time period (Jackson 2001). The overall air quality and hence visibility of the FC-RONR that shares a border with much of the west side of the project area is generally excellent with only short time impacts (Jackson 2002).

The Environmental Protection Agency (EPA) has established NAAQS for six air pollutants; carbon monoxide, ozone, nitrogen dioxide, sulfur dioxide, lead, and particulate matter. As they relate to this project, particulate matter associated with dust and emissions from unpaved roads, vehicles, and equipment are the pollutants of most concern because of potential impacts on human health and visibility. For this analysis PM-2.5, PM-10, nitrogen dioxide, and sulfur dioxide were used as indicators for analysis. The NAAQS for PM-10 (particulate matter less than 10 micrometers in aerodynamic diameter) were established in 1987 and updated in December of 2006. The NAAQS for PM-2.5 (particulate matter less than 2.5 micrometers in aerodynamic diameter) were established in 1997 and updated in December of 2012. Although PM-2.5 causes more severe health effects and visibility impacts than PM-10, the PM-10 standards were retained because they also have the

potential to cause significant health effects. Nitrogen dioxide and sulfur dioxide standards were established in 1971 and have since been amended. According to the NAAQS, PM-10 cannot exceed 150 micrograms/cubic meter (ug/m3) within a 24 hour period and PM-2.5 cannot exceed 35 ug/m3 within a 24 hour period either alone or in combination with existing pollution sources. PM-2.5 has additional annual standards that have a primary lime of 12 ug/m3 and a secondary limit 15 ug/m3 based on a three year average. Nitrogen dioxide cannot exceed 100 parts per billion in a 1 hour period averaged over 3 years and sulfur dioxide cannot exceed 75 parts per billion in a 1 hour period averaged over 3 years. Table 3-76 displays all the NAAQS standards (EPA 2012).

Table 3-76: National Ambient Air Quality Standards (NAAQS)

Pollutant	Primary/ Secondary	Averaging Time	Level	Form
Carbon Monoxide	Primary	8-hour	9 ppm	Not to be exceeded more than once per year
		1-hour	35 ppm	
Lead	Primary and Secondary	Rolling 3 month average	0.15 ug/m^3	Not to be exceeded
Nitrogen Dioxide	Primary	1-hour	100 ppb	98th percentile, averaged over 3 years
	Primary and Secondary	Annual	53 ppb	Annual Mean
Ozone	Primary and Secondary	8-hour	0.075 ppm	Annual fourth-highest daily maximum 8-hr concentration, averaged over 3 years
Particulate Pollution PM-2.5	Primary	Annual	12 ug/m^3	annual mean, averaged over 3 years
	Secondary	Annual	15 ug/m^3	annual mean, averaged over 3 years
	Primary and Secondary	24-hour	35 ug/m^3	98th percentile, averaged over 3 years
Particulate Pollution PM-10	Primary and Secondary	24-hour	150 ug/m^3	Not to be exceeded more than once per year on average over 3 years
Sulfur Dioxide	Primary	1-hour	75 ppb	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
	Secondary	3-hour	0.5 ppm	Not to be exceeded more than once per year

An area that violates the NAAQS is designated as "nonattainment". For the purposes of regulating ambient air quality, the Idaho DEQ does not have baseline data for the affected environment. However, air quality in the project area is generally good to excellent due to the lack of urban and industrial sources and a minimum of other activities (vehicle dust and emissions) in the area that would generate pollutants. Existing sites near Idaho City, Salmon, Garden Valley, Rexburg, Missoula, and McCall monitor PM-2.5 levels. A review of air quality monitors since 2013 revealed that on a 24 hour average all monitors except Rexburg did record a few days where average air quality exceeded a PM-2.5 level of 35. As would be expected Missoula recorded the most days in exceedance with 55 days in 2013 and 2014 (EPA 2013, EPA 2014). On days that had available date in Idaho, a total of 18 days exceeded standards and these were almost exclusively recorded in the summer, winter, and spring months most probably associated with wood burning, wildland/prescribed fires, and stagnant

air masses (IDEQ 2015). The yearly average over 5.5 years within the FC-RONR was 3 ug/m3 for PM-2.5 (Jackson 2002).

Acidic inputs from the atmosphere, mainly sulfate (SO_4) and nitrate (NO_3), can negatively impact aquatic and terrestrial ecosystems (EPA 2001). Their acidifying effects contribute to degradation of stream and lake water quality by lowering the Acid Neutralizing Capacity (ANC) which can be thought of as the water's natural acid buffering system. As the ANC decreases, the pH will eventually decrease and thus the acid levels will increase. The sensitivity of lakes and streams to the negative effects of acid deposition are often linked to natural watershed characteristics, most notably the bedrock geology/lithology types. These areas that receive high levels of acidic deposition and have bedrock geology with a naturally low buffering capacity may exhibit nutrient depletion and stream acidification. Sulfate is the primary component of acidic rain in the eastern U.S., while nitrogen deposition is more of a factor in acidic rain in the mid and western United States (USDA 2012). On the Salmon-Challis National Forest 68 lakes were sampled for acid deposition to determine the ANC. Of these approximately 16 show a low sensitivity (< 50 ANC), 23 are ultra-sensitive (< 75 ANC), eight are very sensitive (75-100 ANC), nine are sensitive (< 200 ANC), and 12 are non-sensitive (> 200 ANC) (Jackson 2001).

The Montana/Idaho Airshed Group, of which the Salmon-Challis National Forest is a member, was formed in 1998 and yearly releases its operating guidelines for public and private land managers within Idaho. The objective of those guidelines is to coordinate prescribed burning among members to minimize smoke-related impacts to air quality; however, the group also functions as a source of data for particulate emissions in general. The Montana/Idaho Airshed Group monitors daily emissions, burning activities, and particulate matter levels with established monitoring units and certified meteorologists.

Class I Areas are subject to the most stringent restrictions relative to additional air pollution. The Clean Air Act established the national visibility goals of preventing any future, and the remedying of any existing, impairment of visibility in mandatory Class I Areas where impairment results from man-made air pollutants. The EPA's regional haze regulations (July 1, 1999) require that all states develop visibility plans to address regional haze impairment of Class I Areas within their state, as well as Class I Areas outside of their state that may be affected by emissions from within their state. Table 3-76 lists the Class I Areas and population centers within a 100 kilometer radius of the project area where impacts may occur. Table 3-77 also discloses the approximate distance and general direction from the project area. Figure 1 displays the sensitive areas surrounding the project area.

Table 3-77.Sensitive Areas

Site	Approximate Distance from Project Area (Kilometers)	Direction from Project Area
Sawtooth Wilderness Area (Class I)	10	South
Hells Canyon Wilderness Area (Class I)	101	West
Selway-Bitterroot Wilderness (Class I)	25	North
Frank Church River of No Return Wilderness (Class II)	0	West
Anaconda-Pintler Wilderness (Class I)	20	North
Red Rock Lake (Class I)	90	East
Craters of the Moon	15	South
Stanley	2	South

Arco	12	South
Mackay	3	Within Project Area
Challis	8	Within Project Area
Salmon	3	Within Project Area
Gibbonsville	0	Within Project Area
Idaho Falls	80	East
Pocatello	101	South East

Alternatives could produce pollutants during project implementation from vehicle trips and air craft.

3.14.4. Environmental Consequences

3.14.4.1. Alternative 1-No Action

Direct and Indirect Effects

This alternative does not propose any activities. Therefore no direct or indirect effects on air quality are expected. Impacts from dust and vehicle/other emissions in the area associated with recreational/other activities would not change appreciably from the existing condition and would continue to contribute particulate matter based on the conditions present at the time of travel. Depending on actual usage of the analysis area, activities would continue to produce dust, nitrogen dioxide, and sulfur dioxide.

3.14.4.2. Alternative 2-Current Action

Direct and Indirect Effects

Under Alternative 2, exhaust pollutants would be generated by project vehicles for the duration of the project. When road moisture levels are low enough project vehicles would generate dust. Access to the treatment sites and transport of equipment and supplies uses fuel and generates exhaust. In relation to national and global fuel use, the fuel consumption and associated emissions from Alternative 2 is minor. Fugitive dust and particulate emissions would occur during the following activities associated with the Alternative 2:

- Operating OHV vehicles
- Driving vehicles on paved and unpaved roads

While Alternative 2 would increase particulates from dust and vehicle emissions in the area, it would not likely have measurable impacts on air quality in any Class I or II areas identified above or at monitoring sites, given the distance and dilution that would occur as particles and air mix over distance. It would take very minimal amounts of mixing and overall air volume to dilute dust and vehicle emissions to levels below air quality standards identified in Table 3-76. Potential impacts to the wilderness user (and user of other NFS land) would be limited to localized impacts from dust prior to dispersal. Dust would be generate and be dispersed to no perceptible level outside the wilderness, but could be perceived by wilderness users on high vistas looking outside the wilderness at the project area. After dispersal, it is no longer perceived by the user. It would not be expected that suspended particles would have a measureable impact on overall visibility in the project area, nor would any deposition likely have measurable impacts on water quality of surface water.

Volatilization is not expected to be an issue; the only herbicide proposed for use with potential for volatilization is dicamba, which may occur from plant surfaces (Extoxnet 1993).

Alternative 2 would treat around 400 acres using bio-control, treat approximately 5,500 acres overall (applied acres) with herbicide using ground application, and treat approximately 40 acres with mechanical/manual removal. The overall fuel consumption and dust generated would be that required to implement this alternative and as described would not likely have measurable impacts on air quality in any Class I or II areas identified above or at monitoring sites.

3.14.4.3. Alternative 3-Proposed Action and Alternative 5-No Aquatic Herbicide Application

Direct and Indirect Effects

Under Alternative 3 and 5, exhaust pollutants would be generated by project vehicles for the duration of the project. When road moisture levels are low enough project vehicles would generate dust. Access to the treatment sites and transport of equipment and supplies uses fuel and generates exhaust. Helicopters would also be used to spray treatment areas as well, application rates vary but several hundred acres can be accomplished in a few hours when conditions are favorable and application volumes of approximately two gallons (water carrier diluted with herbicide) per acre can be achieve. In relation to national and global fuel use, the fuel consumption and associated emissions from Alternative 3 and 5 is minor. Fugitive dust and particulate emissions would occur during the following activities associated with the Proposed Action:

- Operating OHV vehicles
- Driving vehicles on paved and unpaved roads
- Landing and operating of helicopter

While Alternative 3 and 5 would increase particulates from dust and vehicle/helicopter emissions in the area, it would not likely have measurable impacts on air quality in any Class I or II areas identified above or at monitoring sites, given the distance and dilution that would occur as particles and air mix over distance. It would take very minimal amounts of mixing and overall air volume to dilute dust and vehicle/helicopter emissions to levels below air quality standards identified in Table 3-76. Potential impacts to the wilderness user (and user of other NFS land) would be limited to localized impacts from dust prior to dispersal. Dust would be generate and be dispersed to no perceptible level outside the wilderness, but could be perceived by wilderness users on high vistas looking outside the wilderness at the project area. After dispersal, it is no longer perceived by the user. It would not be expected that suspended particles would have a measureable impact on overall visibility in the project area, nor would any deposition likely have measurable impacts on water quality of surface water.

Volatilization is not expected to be an issue; the only herbicide proposed for use with potential for volatilization is dicamba, which may occur from plant surfaces (Extoxnet 1993).

Alternative 3 and 5 would treat around 2,000 acres using bio-control, treat approximately 3,200 acres overall (applied acres) with herbicide using ground application, treat approximately 8,000 acres overall with herbicide using aerial application, and treat approximately 2,000 acres with mechanical/manual removal. The overall fuel consumption and dust generated would be that

required to implement these alternatives and as described would not likely have measurable impacts on air quality in any Class I or II areas identified above or at monitoring sites.

Aerial application of herbicide would have a greater dispersal distance than ground based application generally due in part to the height of boom over foliage. Aerial herbicide application would not occur when sustained wind speeds exceed 5 mph or label recommendations, whichever is less. Actual dispersal distances can vary and depend on many factors such as wind, air stability, nozzle size/angle, and spray pressure (Dexter 1995). Large droplet sizes would be employed to reduce drift. A 100 micron droplet could travel up to 44 feet in a 3 mph wind before falling 10 feet, while a 240 micron droplet would only travel 28 feet in the same wind (Dexter 1995). Given the expected short distances of dispersal of herbicide with project design for sustained wind and the use of large droplets, there is no potential for herbicides to have measureable impacts on air quality on any Class I or II areas identified above or at monitoring sites.

3.14.4.4. Alternative 4-No Aerial Herbicide Application

Direct and Indirect Effects

Under Alternative 4, exhaust pollutants would be generated by project vehicles for the duration of the project. When road moisture levels are low enough project vehicles would generate dust. Access to the treatment sites and transport of equipment and supplies uses fuel and generates exhaust. In relation to national and global fuel use, the fuel consumption and associated emissions from Alternative 4 is minor. Fugitive dust and particulate emissions would occur during the following activities associated with the Alternative 2:

- Operaitve OHV vehicles
- Driving vehicles on paved and unpaved roads

While Alternative 4 would increase particulates from dust and vehicle emissions in the area, it would not likely have measurable impacts on air quality in any Class I or II areas identified above or at monitoring sites, given the distance and dilution that would occur as particles and air mix over distance. It would take very minimal amounts of mixing and overall air volume to dilute dust and vehicle emissions to levels below air quality standards identified in Table 3-76. Potential impacts to the wilderness user (and user of other NFS land) would be limited to localized impacts from dust prior to dispersal. Dust would be generate and be dispersed to no perceptible level outside the wilderness, but could be perceived by wilderness users on high vistas looking outside the wilderness at the project area. After dispersal, it is no longer perceived by the user. It would not be expected that suspended particles would have a measureable impact on overall visibility in the project area, nor would any deposition likely have measurable impacts on water quality of surface water.

Volatilization is not expected to be an issue; the only herbicide proposed for use with potential for volatilization is dicamba, which may occur from plant surfaces (Extoxnet 1993).

Alternative 4 would treat around 2,000 acres using bio-control, treat approximately 6,400 acres overall (applied acres) with herbicide using ground application, and treat approximately 2,000 acres with mechanical/manual removal. The overall fuel consumption and dust generated would be that required to implement this alternative and as described would not likely have measurable impacts on air quality in any Class I or II areas identified above or at monitoring sites.

3.14.5. Cumulative Effects for All Action Alternative

The area used to assess this project's cumulative effects on air quality consists of a 100 kilometer radius around the project area. There are no known past activities that, when combined with proposed activities, would result in a noticeable incremental effect on air quality. Present/Ongoing and Foreseeable future actions considered in this cumulative effects analysis include numerous activities over a very wide area and include, but are not limited to, other prescribed fires, wildfires, wood stoves, logging/mining/industrial activities, road construction/maintenance, vehicle emissions, recreation uses, and/or other sources of pollutants on adjacent National Forest, State, and private lands.

Alternative A does not propose any activities and therefore would have no direct, indirect, or cumulative effects on air quality.

Dust, vehicle, and other emissions that result from Alternatives could combine with air pollutants from other projects, including but not limited to other prescribed fires, wildfires, wood stoves, logging/mining/industrial activities, road construction/maintenance, vehicle emissions, recreation uses, and/or other sources of pollutants on the Salmon-Challis National Forest, adjacent National Forest, State, and private lands. Many of these activities are largely driven by seasonal opportunities or requirements that present parameters on resource managers, landowners, and users to conduct their activities simultaneously. Even though the impacts of these activities are widely spaced over vast, complex terrain, degradation of air quality could occur at localized sites from cumulative effects.

Due principally to the increase in number of acres treated for the various alternatives it can be assumed there is a reasonable correlation between acres treated and overall emission of each alternative, although not a direct correlation. Alternatives 3 and 5 would likely contribute more dust and emissions than Alternative 4 based on acres treated. The least emission of the action alternatives is likely to be Alternative 2 based on acres treated. Alternatives with more acres treated therefore have the potential to contribute more pollutants cumulatively.

Air quality would continue to be monitored at sites throughout the state for daily and annual standards. Organizations such as the Montana/Idaho State Airshed Group would continue to work with agencies to manage inputs such as smoke impacts.

With relation to national and global petroleum reserves, the energy consumption associated with individual alternatives, as well as the differences between alternatives, is insignificant. Additionally, the energy consumption and thus the associated minor emissions would likely have unmeasurable and insignificant effects at a global scale on emissions or greenhouse gas.

3.15. Irreversible and Irretrievable Commitment of Resources

No irreversible or irretrievable commitment of resources associated with the implementation of any action alternatives would be anticipated. In general, the implementation of invasive plant treatments would result in short term impacts followed by long term improvements, for example in groundcover, resulting in improved soil condition and water quality; and restores native vegetation in areas where nonnative plants have been introduced. Design criteria would minimize the magnitude and duration of any short term effects.

Chapter 4. List of Preparers, Glossary, References Cited and Index

4.1. List of Preparers

The following individuals, Federal, State, and local agencies, tribes, and organizations were consulted during the development of this environmental assessment.

Interdisciplinary Team Members and Roles:

Name	Title	Role
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Tim Canaday	Heritage Program Lead	Tribal consultation analysis
Tom Gionet	South Zone Weed Specialist	Vegetation analysis
Michael Helm	GIS Specialist	Maps and data analysis
Karryl Krieger	Planning Program Lead	NEPA coordinator
Bill MacFarlane	Hydrologist	Soil and water resources analysis
Kim Nelson	Administration Staff Officer	Project staff officer
Sara Norman	Writer/Editor	Editor
Jennifer Purvine	Planning Wildlife Biologist	IDT Leader; wildlife, climate change, human health, and economic analysis
Ken Rodgers	NEPA Specialist	Rangeland resources analysis
John Rose	Archaeologist	Cultural resources analysis
Bob Rose	Fisheries Biologist	Fisheries analysis
Diane Schuldt	North Zone Weed Specialist	Vegetation and sensitive plant analysis
Jay Winfield	Salmon-Cobalt District Ranger	Forest Leadership Team liaison

Agencies, Organizations, Businesses and People Notified

Agencies

Advisory Council on Historic Preservation
APHIS
Butte County Commissioners
Butte County Weed Superintendent
Butte County Extension Office
Chief of Naval Operations
Custer County Commissioners
Custer County Extension Office
Custer County Weed Superintendent
Department of Energy
Department of the Interior, Office of the Secretary
Federal Highway Administration
Idaho Association of County Weed Control Superintendents
Idaho Roadless Commission
Lemhi County Commissioners
Lemhi County Extension Agency
Lemhi County Weed Superintendent
Natural Resource Conservation Service
National Marine Fisheries Service
Nez Perce Tribal Executive Committee
Northwest Power Planning Council
OEPC
Sawtooth National Forest
Shoshone Bannock Tribes Business Council
U.S. Army Corp of Engineers
U.S. Environmental Protection Agency

Idaho Department of Fish and Game, Salmon Region
Idaho Department of Parks and Recreation
Idaho State Department of Agriculture
Idaho State Historic Preservation Office
U.S. Fish and Wildlife Service
USDA Office of Civil Rights
USDA Forest Service, Intermountain Region

Organizations/Business

Blue Ribbon Coalition
Chemilogical Weed Management
Committee for the High Desert
Dow AgroSciences
DuPont Crop Protection
Formation Capital Corp., US
Friends of the Bitterroot
Green Jeans Weed and Pest Control
Idaho Adventures
Idaho Conservation League
Idaho Outfitters and Guides Association
Industry Task Force II on 2,4-D Research Data
IVM Partners, Inc.
Lemhi Co. Cattle and Horse Growers
North Wind, Inc.
Salmon Valley Stewardship
Upper Salmon Basin Watershed Project
Weed Goats 2000
Western Ecological Consulting, Inc.
Western Watersheds Project
WildWest Institute

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Steven L. Johnson
Sydney and Karen Dowton
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Travis & Brenda Bullock
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Boone Creek Partnership
Broadie Ranches
Churn Dasher Ranch
Harrop Ranches, Inc.
Isham Farms, Inc.
Last Ranch, LLC
Mays L & L

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Herb Whitworth Jr.
Howard and Zella Cutler
Hubert Miller
Jack P. Jakovac
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James Whittaker
Janelle Phillips
Jay J. Smith
Jim and Maria Dowton
Jim Bennetts
Jim Martiny
Jimmie Waddoups
John A. Aldous Jr
John A. Aldous Sr.
John Lambert
Jon L. or Linell Bills
Josephine Spraker
Judy Madsen
Junior & Lura Baker
Kaden Piva or Kyah Piva
Keith D. Waymire
Keith or Juanna Beth Lewis
Ken Buckwalter
Leon Williams
Leslie Ellsworth
Loah and Bruce Mulkey
Lowell Cerise
Lyle Hutchison
Maureen Roskelly
Mel Ellwein
Mike Stevens
Mitchell Corrigan
Parker Hatch
Paul W. and/or Sally L. Edwards
Penny Hawkins
Phillip R. Goodell II
Murdock Farms
No Tellum Creek Ranch
Nolan Sayer Farming & Ranching
Pancheri Brothers, LLC
Pancheri Inc.
PU Ranch LTD
Smith Family Trust
Sulphur Creek Ranch
Sunset Trust Organization
Triple M Land & Cattle, LLC.
Williams L&L
Guardian LMT Partnership #2 of Lemhi Ranches
Bar 13 Ranch LTD Partnership
Carm-Ida Livestock, Inc
Beyeler Ranches, LLC
Cole Ranch Properties, LLC
Billie Creek Cattle
Leadore Land Partners
McFarland Livestock Co. Inc.
Shiner Ranch, Inc.
Quinton Snook and Sons
Peterson Land and Livestock
Udy Ranches, LLC.
Tonsmeire Revocable Trust
Wilson Ranches, LLC.
Circle Pi Ranch
Flying Resort Ranches (Flying B)
Salmon River Ranches
Christopher James Trust
Mountain Springs Ranch LLC
Albert Fullmer
Allan or Betty Purcell
Alvin Crawford
Bart & Tina Wojciechowski
Ben & Lynette O'Neal
Preston Cutler
Randy Capps
Randy Pehrson
Rocky Ross
Roger Swanson
Roy and Sharon Hoffman
Roy Hoffman Jr.
Ryan Hughes
Scott Johnson

4.2. Glossary

Abundance: The number of organisms in a population, combining density within inhabited areas and number and size of inhabited areas.

Adaptive Management: A system of management practices based on clearly identified intended outcomes and monitoring to determine if management actions are meeting those outcomes; and, if not, to facilitate management changes that will best ensure that those outcomes are met or reevaluated. Adaptive management stems from the recognition that knowledge about natural resource systems is sometimes uncertain.

Adsorption: The adhesion of gas, liquid, or dissolved solid particles to a surface.

Alkaline: Having a pH greater than 7.0.

Allelopathy: The inhibition of growth in one plant species by chemicals produced by another plant. For example, other plants will often not grow underneath black walnut trees, since these trees produce a chemical inhibiting plant respiration.

Alluvial: Pertaining to material that is transported and deposited by running water. ALS Inhibitor: Herbicides that inhibit acetolactate synthase (ALS), the enzyme common to the biosynthesis of branch-chain amino acids. These include imazamox, imazapic, metsulfuron methyl, and chlorsulfuron.

Aquifer: A geologic formation or structure that transmits water in sufficient quantity to supply the needs for a water development, such as a well.

Basal: see Rosette

Best Management Practice (BMP): A practice or combination of practices, that is determined by a State (or designated area-wide planning agency) after problem assessment, examination of alternative practices, and appropriate public participation to be the most effective, practical (including technological, economic, and institutional considerations) means of preventing or reducing the amount of pollution generated by nonpoint sources to a level compatible with water quality goals.

Biological Control: Intentional actions to foster the reduction of pest populations by natural competitors, predators, or parasites (often referred to as agents), thereby providing a sustainable and highly selective solution to many widely spread infestations. Release of natural competitors might enhance control and reduce the rate of expansion of large existing infestations. While most often involving the use of insect agents, fungi, and other microbes, such as the bacterial insecticide *Bacillus thuringiensis* var. kurstaki (Btk) can also provide biological control

Biomass: The total weight of all living organisms or specific group of organisms in a biological community.

Broadcast Application: An herbicide application of over an entire area or field rather than only on rows, beds, or individual plants

Buffer: A vegetative strip or management zone of varying size, shape, and character maintained along a stream, lake, road, recreation site, and different vegetation zone to mitigate the impacts of actions on adjacent lands, to enhance aesthetic values, or as a best management practice.

Candidate Species: Those plant and animal species that, in the opinion of the Fish and Wildlife Service, may become endangered or threatened.

Carrying Capacity: The maximum population size that can be supported indefinitely by a given environment.

Channel aggradation: An increase in the elevation of the stream bed as a result of deposition of sediment.

Clay soil texture: A soil texture type consisting of 40 percent or more clay-sized particles, less than 40 percent silt-sized particles and less than 45 percent sand-sized particles.

Control: With respect to invasive species (plant, pathogen, vertebrate, or invertebrate species), control is defined as any activity or action taken to reduce the population, contain, limit the spread, or reduce the effects of an invasive species. Control activities are generally directed at established free-living infestations, and may not necessarily be intended to eradicate the targeted infestation in all cases.

Cover: canopy space occupied by a particular species, plant type, or community

Cryptogamic soil crust: A community of cyanobacteria, mosses, and lichens on the soil surface, also known as biological soil crust. Biological soil crusts play important ecological roles in soil stabilization, carbon fixation, nitrogen fixation, and plant germination.

Designated use: Those uses specified in water quality standards for each water body or segment whether or not they are being attained.

Distribution: The spatial range of a species, usually on a geographic but sometimes on a smaller scale, or the arrangement or spatial pattern of a species over its habitat.

Disturbance: Any event, such as forest fire or insect infestations that alter the structure, composition, or functions of an ecosystem.

Diversion: The removal of water from its natural course or location by means of a ditch, canal, pipeline, or other conduit.

Drift: The movement of airborne particles by air motion or wind away from the intended target area.

Early Detection: The process of finding, identifying, and quantifying new, small, or previously unknown infestations of aquatic or terrestrial invasive species prior to (or in the initial stages of) its establishment as free-living expanding population. Early detection of an invasive species is typically coupled with integrated activities to rapidly assess and respond with quick and immediate actions to eradicate, control, or contain it.

Ecological Stage: see successional stage.

Ecosystem: A community of living organisms (plants, animals, and microbes) in conjunction with the nonliving components of their environment (i.e., air, water, and mineral soil), interacting as a system. These components are regarded as linked together through nutrient cycles and energy flows.

Emergence: The act of germinating seedling's breaking through the soil surface.

Ephemeral stream: A stream or portion of a stream that flows only in direct response to precipitation. It receives little or no water from springs and no long-continued supply from snow or other sources. Its channel is at all times above the water table.

Endangered Species**:** Any species in danger of extinction throughout all or a significant portion of its range. This does not include a species of the Class Insecta determined by the Secretary to be a pest whose protection under the provisions of the Endangered Species Act of 1973, as amended, would present an overwhelming and overriding risk to humans.

Endangered Species Act (ESA): The ESA provides for the conservation of threatened and endangered species of plants and animals. The ESA requires Federal agencies to ensure that actions (including pesticide use) they authorize, fund, or carry out are not likely to jeopardize the continued existence of any threatened or endangered species or result in the destruction of adverse modification of the species' critical habitat. The ESA also amended FIFRA to define imminent hazard to include situations involving unreasonable hazard to the survival of a species declared by the Secretary of the Interior to be endangered or threatened.

Endemic: A plant or animal that occurs naturally in a certain region and whose distribution is relatively limited geographically.

Eradication: With respect to invasive species (plant, pathogen, vertebrate, or invertebrate species), eradication is defined as the removal or elimination of the last remaining individual invasive species in the target infestation on a given site. It is determined to be complete when the target species is absent from the site for a continuous time period (that is, several years after the last individual was observed). Eradication of an infestation of invasive species is relative to the time-frame provided for the treatment procedures. Considering the need for multiple treatments over time, certain populations can be eradicated using proper integrated management techniques.

Establishment: Initiation of a free-living, reproducing population of an invasive species.

Estimated Environmental Concentration: The predicted concentration of a pesticide within an environmental compartment based on estimates of qualities released, discharge patterns and inherent disposition of the pesticide (fate and distribution) as well as the nature of the specific receiving ecosystems.

Exposure Scenario: Exposure scenarios consider both the toxicity of a given chemical and the mechanism by which an organism may encounter it. The application rate and method influences whether a person, animal or non-target plant could be adversely affected by exposure to a particular herbicide.

Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA): This act provides the authority for the registration, distribution, sale, shipment, receipt, and use of pesticides. The Forest Service may only use pesticides registered or otherwise permitted in accordance with this Act. The FIFRA directs the Secretary of Agriculture, in cooperation with the Administrator of the U. S. Environmental Protection Agency (EPA), to implement research, demonstration, and education programs to support adoption of Integrated Pest Management (IPM), and to make information on IPM widely

available to pesticide users, including Federal agencies. Federal agencies shall use IPM techniques in carrying out pest management activities and shall promote IPM through procurement and regulatory policies and other activities.

Floodplain: The lowland and relatively flat areas adjoining inland waters that are covered by its waters during flooding.

Forb: A broad-leaved herb that is not a graminoid.

Graminoid: Grasses which are botanically, any plant of the Gramineae family. Grasses are characterized by narrow leaves with parallel veins; by leaves composed of blade, sheath, and ligule; by jointed stems and fibrous roots; and by inconspicuous flowers usually arranged in spikelets.)

Half-life: The time required for half of something to undergo a process. As used in this document, it is the amount of time for half the herbicide to break down, becoming ineffective.

Hazard Quotient (HQ): The Hazard Quotient is the amount of herbicide or additives to which an organism may be exposed over a specified period divided by that estimated daily exposure level at which no adverse health effects are likely to occur. An HQ less than or equal to one indicates an extremely low level of risk; therefore, an HQ less than or equal to one is presumed to indicate a level of exposure below the level of concern (LOC) for adverse health effects.

Herbicide: Any substance or mixture of substances intended for use as a plant regulator, defoliant, or desiccant.)

Hydrolysis: The chemical breakdown of a compound due to reaction with water.

Infiltration: The movement of water into the soil through pores or other openings.

Infestation: An invasive species population within a specified area.

Integrated Pest Management (IPM): A pest (in this context an invasive species) control strategy based on the determination of an economic, human health, or environmental threshold that indicates when a pest population is approaching the level at which control measures are necessary to prevent a decline in the desired conditions (economic or environmental factors). In principle, IPM is an ecologically-based holistic strategy that relies on natural mortality factors, such as natural enemies, weather, and environmental management, and seeks control tactics that disrupt these factors as little as possible. Integrated pest management techniques are defined within four broad categories: 1) Biological, 2) Cultural, 3) Mechanical/Physical, and 4) Chemical techniques.

Intermittent stream: Streams which, in general, flow during wet seasons and are dry during dry seasons. Flow is derived principally from surface runoff, but during wet seasons receives a contribution from groundwater.

Interstitial**:** referring to an opening or space, especially open spaces between plants.

Introduction: The initial movement of a species to any location outside of its documented native geographical range.

Invasive Plant Management: Any activity that directly intervenes to minimize the spread and adverse effects of an invasive species, including preventing, controlling, containing, eradicating,

surveying, detecting, identifying, inventorying, and monitoring invasive species; rehabilitating and restoring affected sites; and providing technical outreach and educational activities related to invasive species. Management actions in the National Forest System are based upon species-specific or site-specific plans (including forest plans, integrated pest management plans, watershed restoration plans, and so forth), and support the accomplishment of plan goals and objectives and achieve successful restoration or protection of priority areas identified in the respective plan(s).

Invasive Species: Executive Order 13112 defines an invasive species as "an alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health." The Forest Service relies on Executive Order 13112 to provide the basis for labeling certain organisms as invasive. Based on this definition, the labeling of a species as "invasive" requires closely examining both the origin and effects of the species. The key is that the species must cause, or be likely to cause, harm and be exotic to the ecosystem it has infested before we can consider labeling it as "invasive". Thus, native pests are not considered "invasive", even though they may cause harm. Invasive species infest both aquatic and terrestrial areas and can be identified within any of the following four taxonomic categories: Plants, Vertebrates, Invertebrates, and Pathogens. Additional information on this definition can be found in Executive Order 13112.

Invasive Species Management: Activities to prevent, control, contain, eradicate, survey, detect, identify, inventory, and monitor invasive species; includes rehabilitation and restoration of affected sites and educational activities related to invasive species. Management actions are based upon species-specific or site-specific plans (including forest plans, IPM plans, watershed restoration plans, and so forth), and support the accomplishment of plan goals and objectives and achieve successful restoration or protection of priority areas identified in the respective plan(s).

Inventory: Invasive species inventories are generally defined as the observance and collection of information related to the occurrence, population or infestation of the detected species across the landscape or with respect to a more narrowly-defined area or site. Inventory attributes and purposes will vary, but are typically designed to meet specific management objectives which need information about the extent of an invasive species infestation. Inventories are typically conducted to quantify the extent of, and other attributes related to, infestations identified during survey activities.

Landtype (US Forest Service usage): Visually identifiable unit areas resulting from homogeneous geomorphic and climatic processes and having defined patterns of soils and vegetative potentials. Landtype units range in size from about one-tenth to one square mile. Their size and composition depend upon the significance of physical characteristics which can be readily interpreted to identify hazard, capability and productivity potentials that are reliable for land use planning purposes. Landtype units generally have uniform management response characteristics and so can be used to identify areas for which zoning and resource allocation decisions can be made.

Leaching: The process by which materials in the soil (such as nutrients or pesticides) are washed downward into the soil by the movement of water.

LC_{50}-Median Lethal Concentration: The statistically derived concentration of a pesticide in an environmental medium expected to kill 50 percent of test organisms in a given population

Level of Concern (LOC): An estimate of exposure above which there may be adverse effects; in risk assessments this is defined as a hazard quotient (HQ) of more than one.

Listed Species**:** Any species of fish, wildlife, or plant officially designated as endangered or threatened by the Secretary of the Interior or Commerce.

Litter**:** The uppermost slightly decayed layer of organic matter on the forest floor or, more generally, beneath any plants.

Loamy soil texture: A soil that is a mixture of sand, silt, and clay-sized particles.

Lowest Observed Effect Level (LOEL): The lowest exposure concentration associated with an adverse effect.

Maximum Acceptable Toxicant Concentration (MATC): A value that is calculated through aquatic toxicity tests to help set water quality regulations for the protection of aquatic life. Using the results of a partial life-cycle chronic toxicity test, the MATC is reported as the geometric mean between the No Observed Effect Concentration (NOEC) and the Lowest Observed Effect Concentration (LOEC).

Mechanical control: Physical removal of invasive species by hand-pulling small infestations before flowers have bloomed, tilling larger infestations for several years, removing infested trees, squashing insect pests, etc.

Monitoring: For the purposes of invasive species program performance and accountability, the term "monitoring" refers to the observance and recording of information related to the responses to treating an invasive species infestation, and reported as treatment efficacy. By monitoring the treatment results over time, a measure of overall programmatic treatment efficacy can be determined and an adaptive management process can be used in subsequent treatment activities.

Monoculture: the cultivation or growth of a single crop or organism especially on agricultural or forest land.

Mortality: Refers to the rate of death of a species in a given population or community.

Municipal Watershed: A watershed that serves a public water system as defined in the Safe Drinking Water Act of 1974, as amended (42 U.S.C. §§ 300f, et seq.); or as defined in state safe drinking water statutes or regulations.

Mycorrhiza: A symbiotic association between a fungus and the roots of vascular plants.

Native Species: A species living or growing naturally in a particular place or region; indigenous, not introduced.

Niche: 1) The role played by (occupation or profession) and the address of a particular species in its ecosystem; 2) the range of conditions, resource levels and densities of other species allowing survival, growth and reproduction of organisms or species.

No Observed Adverse Effect Level (Human Health Risk Assessment)/No Observed Adverse Effect Concentration (Ecological Risk Assessment) (NOAEL/NOAEC): Effects that are attributable to treatment but do not appear to impair the organisms ability to function and clearly do not lead to such impairment.

Non-native (introduced) species**:** Any organism that is not native to the ecosystem being considered.

Nonpoint source pollution: Diffuse sources of water pollution that originate from many indefinable sources and normally include agricultural and urban runoff, runoff from construction activities, and so forth. In practical terms, nonpoint sources do not discharge at a specific, single location (such as a single pipe). Nonpoint source pollutants are generally carried over or through the soil and ground cover via stormflow processes. Unlike point sources of pollution (such as industrial and municipal effluent discharge pipes), nonpoint sources are diffuse and can come from any land area

Non-native (introduced): species: Any organism that is not native to the ecosystem being considered.

Non-selective Herbicide: Chemicals or formulations that destroy or prevent plant life in general without regard to species.

Non-target Species: Plant species not singled out for management or control, may be native or non-native.

Noxious Weed: The term "noxious weed" is defined for the Federal Government in the Plant Protection Act of 2000 and in some individual State statutes. For purposes of this chapter, the term has the same meaning as found in the Plant Protection Act of 2000 as follows: The term "noxious weed" means any plant or plant product that can directly or indirectly injure or cause damage to crops (including nursery stock or plant products), livestock, poultry, or other interests of agriculture, irrigation, navigation, the natural resources of the United States, the public health, or the environment. The term typically describes species of plants that have been determined to be undesirable or injurious in some capacity. Federal noxious weeds are regulated by USDA-Animal and Plant Health Inspection Service under the Plant Protection Act of 2000, which superseded the Federal Noxious Weed Act of 1974. State statues for noxious weeds vary widely, with some States lacking any laws defining or regulating noxious weeds. Depending on the individual State law, some plants listed by a State statute as "noxious" may be native plants which that State has determined to be undesirable. When the species are native, they are not considered invasive species by the Federal Government. However, in most cases, State noxious weed lists include only exotic (non-native) species.

Overland Flow: The rain storm or snow melt runoff water which flows over the ground surface as a thin layer, as opposed to the channelized (concentrated) runoff which occurs in rills and gulleys.

Peak flow: The maximum volume of flow attained at a given point in a stream during a runoff event.

Percolation: The downward movement of water within a soil, especially the downward flow of water in saturated or nearly saturated soil.

Perennial stream: A stream that has permanently present surface water. Flows occur throughout the year except possibly during extreme drought or during extreme cold when ice forms.

Persistence: The length of time an herbicide remains active in the soil.

Physiological: characteristic of or appropriate to an organism's healthy or normal biological and chemical functioning

Photodegradation: Degradation by means of radiant energy (as light).

Photolysis: Chemical decomposition by the action of radiant energy (as light).

Plant Community: The species that occur together in space and time.

Plausible Effects: The analysis focuses on whether effects that are possible based on risk assessments are plausible, given site conditions, herbicide application methods and Design Criteria. Design Criteria are used to minimize or eliminate the plausibility of effects identified in the risk assessments.

Population: Any group of individuals, usually of a single species, occupying a given area at the same time.

Prevention: Prevention measures for invasive species management programs include a wide range of actions and activities to reduce or eliminate the chance of an invasive species entering or becoming established in a particular area. Preventative activities can include projects for education and awareness as well as more traditional prevention activities such as vehicle/equipment cleaning, boat inspections, or native plant restoration plantings. Restoration activities typically prevent invasive species infestations by improving site resilience, and reducing or eliminating the conditions on a site that may facilitate or promote invasive species establishment.

Range: see distribution

Rapid Response: With respect to invasive species (plant, pathogen, vertebrate, or invertebrate species), rapid responses are defined as the quick and immediate actions taken to eradicate, control, or contain infestations that must be completed within a relatively short time to maximize the biological and economic effectiveness against the targeted invasive species. Depending on the risk of the targeted invasive species, rapid response actions may be supported by an emergency situation determination and emergency considerations would include the geographic extent of the infestation, distance from other known infestations, mobility and rate of spread of the invasive species, threat level and potential impacts, and available treatments.

Reference Dose (RfD): A defined level that is not believed to be associated with any adverse effect. Both chronic and acute RfDs are characterized in risk assessments.

Regime: A prevailing pattern of events over time, especially of disturbance and climate.

Residual Activity: An herbicide that prevents the growth of plants when present in the soil. Soil residual effects may be temporary or relatively permanent.

Resilience: Capacity of an ecosystem to respond to a perturbation or disturbance by resisting damage and recovering quickly.

Restoration & Rehabilitation: Following a disturbance, the active or passive management of an ecosystem or habitat to restore ecosystem structure and function and prevent re-invasion by improving site resilience and reducing or eliminating the conditions on a site that might facilitate or promote invasive species establishment.

Restored: With respect to performance specifically, the invasive species program is driven by an outcome-based performance measure centered on ‘restoration’. An area treated (see “treatment” definition) against invasive species has been ‘restored’ when the targeted invasive species defined in the project plan was controlled or eradicated directly as a result of the treatment activity. In some instances, actions taken across particular areas to prevent the establishment and spread of specific invasive species are also included in this treatment definition. ‘Restored’ acres are a subset of

'treated' acres, which are tracked annually to determine the effectiveness of treatments. Preventing, controlling, or eradicating invasive species assists in the recovery of the area's resilience and the capacity of a system to adapt to change if the environment where the system exists has been degraded, damaged, or destroyed (in this case by invasive species); and helps to reestablish ecosystem functions by modifying or managing composition and processes necessary to make terrestrial and aquatic ecosystems sustainable, and resilient, under current and future conditions (as described in FSM 2020). In most cases, this is a performance measure defined in the project plan, and project managers have the flexibility to set the parameters for determining when the treated areas have been restored. Absence of an individual invasive species organism, whether through eradication or prevention efforts, is most often the criteria used to determine when acres have been restored. Monitoring treatment efficacy is critical to reporting invasive species management performance.

Resilience: The capacity of an ecosystem to absorb disturbance and reorganize while undergoing change, so as to still retain essentially the same function, structure, identity, and feedbacks. By working toward the goals of diverse native ecosystems that are connected and can absorb disturbance, it is expected that over time, management would create ecological conditions that support the abundance and distribution of native species within a geographic area to provide for native plant and animal diversity.

Restoration & Rehabilitation: Following a disturbance, the active or passive management of an ecosystem or habitat to restore ecosystem structure and function and prevent re-invasion by improving site resilience and reducing or eliminating the conditions on a site that might facilitate or promote invasive species establishment.

Rhizomatous: Having a persistent underground root system from which a plant can produce new shoots even if the original plant is cut down.

Riparian Area: Geographically delineable areas with distinctive resource values and characteristics that are comprised of the aquatic and riparian ecosystems.

Riparian Ecosystems: A transition area between the aquatic ecosystem and the adjacent terrestrial ecosystem; identified by soil characteristics or distinctive vegetation communities that require free or unbound water.

Riparian Habitat Conservation Area (RHCA): Portions of watersheds where riparian-dependent resources receive primary emphasis, and management activities are subject to specific standards and guidelines. RHCAs include traditional riparian corridors, wetlands, intermittent headwater streams, and other areas where proper ecological functioning is crucial to maintenance of the stream's water, sediment, woody debris, and nutrient delivery systems.

Riparian Management Objective (RMO): Quantifiable measures of stream and stream-side conditions that define good anadromous fish habitat, and serve as indicators against which attainment, or progress toward attainment, of the goals will be measured.

Risk assessments: a qualitative evaluation of the probability that the use of herbicide may pose a risk to human health or the environment. They contain:

- Hazard Characterization- What are the dangers inherent with the active ingredient?
- Exposure Assessment- Who could come into contact and how much?
- Dose Response Assessment- How much is too much?

- Risk Characterization- Indicates whether or not there is a plausible basis for concern

Risk Quotient: Risk Quotients are calculated by dividing exposure estimates by the acute and chronic ecotoxicity values.

Rosette: The basal or early leaves of a plant, before bolting.

Sediment load: The quantity of sediment, measured in dry weight or by volume, transported through a stream cross-section in a given time. Sediment discharge consists of both suspended load and bedload.

Sediment yield: The amount of sediment per unit area removed from a watershed by flowing water during a specified period of time.

Selective Herbicide: A chemical that is more toxic to some plant species than to others (may be a function of dosage or mode of application).

Sensitive Species: Those plant and animal species identified by a regional forester for which population viability is a concern, as evidenced by: a) Significant current or predicted downward trends in population numbers or density. b) Significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution.

Seral: The stage of succession of a plant or animal community that is transitional. If left alone, the seral stage will give way to another plant or animal community that represents a further stage of succession.

Soil Condition: Description of the status of a soil's physical, chemical, and biological properties at any point in time. This may be a qualitative or quantitative description.

Soil productivity: The inherent capacity of the soil resource to support appropriate site-specific biological resource management objectives, which includes the growth of specified plants, plant communities, or a sequence of plant communities to support multiple land uses.

Sorption Coefficient: A measure of the strength at which a chemical adheres to soil in preference to remaining dissolved in water. The higher the number, the more readily an herbicide binds to soil particles.

Spray Adjuvants: is a catchall phrase for substances added to an herbicide or spray mix to aid mixing and applying or to improve the efficacy of an herbicide application.

Survey: An invasive species survey is a process of systematically searching a geographic area for a particular (targeted) invasive species, or a group of invasive species, to determine if the species exists in that area. It is important to know where and when surveys have occurred, even if the object of the survey (target species) was not located. Information on the absence of an invasive species can be as valuable as information on the presence of the species, and can be used as a foundation to an early detection system. Unlike inventories, surveys typically do not collect additional detailed attributes of the infestation or the associated site.

Structure: The list of species and their relative abundance in a community. Also, spatial arrangement both horizontally and vertically. Structure might reveal a pattern, or mosaic, or total randomness of vegetation. (University of Salzburg, AUT, FS Ecosystem Management Terms)

Succession: The natural replacement, in time, of one plant community with another. Conditions of the prior plant community (or successional stage) create conditions that are favorable for the establishment of the next stage.

Successional stage: A stage of development of a plant community as it moves from bare ground to climax. For example, the grass-forb stage of succession precedes the woody shrub stage.

Susceptible: see Vulnerable. Also, referring to plants not tolerant of herbicide.

Talus: Rock fragments that have accumulated at the base of a cliff or slope.

Target species: An individual invasive species or population of invasive species, which has been prioritized for research or management action based upon environmental, economic, or human impacts, risk assessments, or other decision support tools.

Threatened species: Any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range and that the appropriate Secretary has designated as a threatened species. (Some states also have declared certain species as threatened through their regulations or statutes.)

Tolerant: Capable of withstanding effects. For example, grass is tolerant of 2,4-D to the extent that this herbicide can be used selectively to control broadleaf weeds without killing the grass.

Total Maximum Daily Load (TMDL): A calculation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards, and an allocation of that load among the various sources of that pollutant.

Translocation: Transfer of sugars or other materials such as 2,4-D from one part to another in plants.

Treatment: Any activity or action taken to directly prevent, control, or eradicate a targeted invasive species. Treatment of an invasive species infestation may not necessarily result in the elimination of the infestation, and multiple treatments on the same site or population are sometimes required to affect a change in the status of the infestation. Treatment activities typically fall within any of the four general categories of integrated management techniques: Biological treatments, Cultural treatments, Mechanical treatments, or Chemical treatments. For example, the use of domestic goats to control invasive plants would be considered a biological treatment; the use of a pesticide to control invasive fishes would be characterized as a chemical treatment; planting of native seeds used to prevent invasive species infestations and restore a degraded site would be considered a cultural treatment technique; developing an aquatic species barrier to prevent invasive species from spreading throughout a watershed would be considered a physical treatment; cleaning, scraping, or otherwise removing invasive species attached to equipment, structures, or vehicles would be considered a mechanical treatment designed to directly control and prevent the spread of those species.

Turbidity: The amount of solid particles that are suspended in water and that cause light rays shining through the water to scatter. Turbidity makes the water cloudy or even opaque in extreme cases.

µg: Microgram, a unit of mass equal to one millionth of a gram.

Vector: Routes or means of introducing invasive species to an area: pathways for invasion. For example, roadways, trails, streams and wind are all vectors for invasion.

Viable Population: A population that has the estimated numbers and distribution of reproductive individuals to ensure the continued existence of the species throughout its existing range (or range required to meet recovery for listed species) within the planning area.

Vigor: active healthy well-balanced growth especially of plants.

Vulnerable: being at risk, especially a plant community at risk of being degraded in quality though the invasion of aggressive, non-native species.

Volatilization: Evaporation or vaporization of an herbicide compound (changes from liquid to a gas) at ordinary temperatures on exposure to the air.

Watershed: The entire region drained by a waterway (or into a lake or reservoir. More specifically, a watershed is an area of land above a given point on a stream that contributes water to the streamflow at that point.

Water solubility: A measure of how readily a chemical or substance will dissolve in water.

Water table: The upper surface of the groundwater or that depth below which the soil is saturated with water.

Watershed: The catchment area of land draining into a river, river system, or body of water; the drainage basin contributing water, organic matter, dissolved nutrients, and sediments to a stream or lake. The United States Geological Survey created a hierarchical system of 6 levels of hydrologic units, each described by a unique Hydrologic Unit Code (HUC).

Watershed, 4th-level: A watershed defined at the “sub-basin” scale. The HUC contains 8 digits, and the average watershed size is 700 square miles.

Watershed, 5th- level: A watershed defined at the “watershed” scale. The HUC contains 10 digits, and the watershed size generally ranges from 40,000 to 250,000 acres.

Watershed, 6th-level: A watershed defined at the “sub-watershed” scale. The HUC contains 12 digits, and the watershed size generally ranges from 10,000 to 40,000 acres.

Wetland: Those areas that are inundated by surface or ground water with a frequency sufficient to support and that, under normal circumstances, do or would support a prevalence of vegetation or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction. Wetlands generally include swamps, marshes, bogs, and similar areas such as sloughs, potholes, wet meadows, river overflows, mud flats, and natural ponds.

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4.4. References Cited

Ainsworth, N. 2003. Integration of Herbicides with Arthropod BioControl Agents for Weed Control. *BioControl Science and Technology , 13*(6), 547-570.

Alford, E.R., J.M. Vivanco, and M.W. Paschke. 2009. The Effects of Flavonoid Allelochemicals from Knapweeds on Legume-Rhizobia Candidates for Restoration. *Restoration Ecology , 17*(4), 506-514.

Alpert, P. E. 2000. Invasibility and Role of Environmental Stress in the Spread of Non-Native Plants. *Perspectives in Plant Ecology, Evolution and Systematics, 3*(1), 52-66.

Amquist, T.L. and R.G. Lym. 2010. Effect of Aminopyralid on Canada thistle (Cirsium arvense) and the Native Community in a Restored Tallgrass Prairie. *Invasive Plant Science and Management, 3*(2), 155-168.

Animal and Plant Health Inspection Service (APHIS). 2010. *Pest Alert Mongulones cruciger.* Plant Protection and Aquarantine 03-2010.

Anderson, W. P. 2007. Weed Science Principles and Applications (3rd Edition). Chapter 5 Herbicides and the Soil. Long Grove, Ill: Waveland Press.

Bailey, R. 1980. *Description of the Ecoregions of the US. Miscellaneous Publication 1391, .* Ogden, Utah : U.S. Deparmtent of Agriculture, Forest Service, Intermountain Research Station.

Bailey, R. 1995. *Description of Ecoregions of the U.S. UPDATE to Miscellaneous Publication 1391*. Ogden, Utah: U.S. Department of Agriculture, Forest Service, Intermoutain Research Station.

Bakke, D. 2001. *A Reveiw and Assessment of the Results of Water Monitoring for Herbicide Residues for the Years 1991 to 1999, USFS Region Five. Unpublished Report.* U.S. Deparment of Agriculture, Forest Service, Region 5.

Bakke, D. 2007. Analysis of issues surrounding the use of spray adjuvants with herbicides. USDA Forest Service Pacific Southwest Region. Unpub. Report. 61 pp.

Bakke, D. 2015. Current response to IARC listing of glyphosate as a carcinogen. Unpub. report. April 16, 2015. 2 pp.

Bangsund, D.A., J.A. Leith, and F.L. Leistritz. 1996. *Economic Analysis of Herbicide Control of Leafy Spurge in Rangeland.* North Dakota State University, North Dakota Agricultural Experiement Station, NDSU Agricultural Economics Report No. 342-S , Fargo, North Dakota.

Barthell, J., J. Randall, R. Thorp and A. Wenner. 2001. Promotionof Seed Set in Yellow Star-thistle by Honey Bees: Evidence of and Invasive Mutualism. *Ecological Applications*, 11(6): 1870-1883.

BASF. 2009. Clearcast (Imazamox) Speciment Herbicide Label. 12 pp. .

BASF. 2011. Plateau Specimen Label. 15 pp.

BASF. 2012. Arsenal (Imazapyr) Speciment Label. 21 pp. .

Beck, K. 1994. How do weeds affect us all? . *Leafy Spurge Symposium, July 26-29*, (pp. 3-4). Bozeman, Montana.

Beck, K. 2013. *Economics of Invasive Weed Control: Chemical, Manual/Physical/Fire, Biological, and Doing Nothing.* Retrieved from Center for Inasive Species Management, Invasive Plant Management Technical Webinar Series: http://www.weedcenter.org/technicalwebinars/resrouce.html

Belcher, J.W. and S.D. Wilson. 1989. Leafy Spurge and the Species Composition of a Mixed Grass Prairie. *Journal of Range Managment, 42*(2), 172-175.

Bird, S.L., D.M. Esterly, and S.G. Perry. 1996. Off-target Deposition of Pesticides from Agricultural Aerial Spray Applications. *Journal of Environmental Quality, 25*(5), 1095-1104.

Bjornn, T.C. and D.W. Reiser. 1991. Habitat Requirements of Salmonids in Streams. In W. Meehan (Ed.), *Influences of Forest and Rangeland Management on Salmonid Fishes and Their Habitats* (pp. 83-138 pp.). Bethesda, Maryland: American Fisheries Society Special Publication 19.

Bowes, G. 1976. Control of Aspen, Poplar, Balsam-Poplar, Prickly Rose and Western Snowberry with metsulfuron-methyl and 2,4-D. *Jounral of Range Management* 29(2): 148-150.

Bowes, G.G. and D.R. Spurr. 1996. Control of Aspen Poplar, Balsam Poplar, Prickly Rose and Western Snowberry with metsulfuron-methyl and 2,4-D. *Canadian Journal of Plant Science, 76*(4), 885-889.

Bradley, B.A., M. Oppenheimer, and D.S. Wilcove. 2009. Climate Change and Plant Invasions: Restoration Opportunities Ahead? *Global Change Biology, 15*(5), 1551-1521.

Branham, B.E. and K.V. Hanson. 1987. Drift and Volatility of Broadleaf Herbicides. *57th Annual Michigan Turfgrass Conference Proceedings, January 12-14, 1987*, *16*, pp. 127-129. Lansing, Michigan.

Brooks, M.L. and D.A. Pyke. 2001. Invasive Plant and Fire in the Deserts of North America. pp. 1-14 in Galley, K.E.M. and T.P Wilson (eds.) *Proceedings of the Invasive Species Workshop: the Role of Fire in the Control and Spread ov Invasive Species Fire Conference 2000: the First National Congress on Fire Ecology, Prevention and Managment.*, *Miscellaneous Publication No. 11*, p. 14 pp. Tall timbers Reserach Station, Tallahasses, Florida.

Brown, C.S., V.J. Anerson, V.P. Claassen, M.E. Stannard, L.M. Wilson, S.Y. Atkinson, J.E. Bromberg, T.A. Grant III and M.D. Munis. 2008. Restoration Ecology and Invasive Plants in the Semiarid West. *Invasive Platn Scient and Management, 1*(4), 399-413.

Burke, I.C., W.A. Reiners and R.K. Olson. 1989. Topographic Control of Vegetation in a Mountain Big Sagebrush Stepp. *Vegetation, 84*(2), 77-86.

Bussan, A.J. and W.E. Dyer. 1999. Herbicides and Rangelands. In R. a. Sheley (Ed.), *Biology and Management of Noxious Rangeland Weeds* (pp. 116-132). Corvallis, Oregon: Oregon State University Press.

Butler, J.L. and S.D. Wacker. 2010. Lack of Native Vegetation Recovery Following Biological Control of Leafy Spruge. *Rangeland Ecology and Management, 63*(5), 553-563.

Callaway, R.M. and W.M. Ridenour. 2004. Novel Weapons: Invasive Success and the Evolution of Increases Competeive Ability. *Frontiers in Ecology and the Environment, 2*(8), 436-443.

Callaway, R.M., T.C. Giles, S. Barth, P.W. Ramsey and J.E. Gannon. 2004. Soil Fungi Alter Interactions Between Invader Centaurea maculosa and North American Natives. *Ecology, 85*(4), 1062-1071.

Canaday, T. 2012. *A Cutrual Resrouce Overview of the Frank Church River of No Return Wilderness, Report Number SL-11-1618.* Salmon, Idaho: On file: Salmon-Challis National Forest.

Charles, H. and J.S. Dukes. 2007. Impacts of Invasive Species on Ecosystem Services. In W. Nentwig (Ed.), *Ecological Studies, Vol. 193, Biological Invasions* (pp. 217-237). New York: Springer-Verlag Berlin Heidelberg.

Chen, I., J.K. Hill, R. Ohlemuller, D.B. Roy, and C.D. Thomas 2011. Rapid Range Shifts of Species Associated with High Levels of Climat Warming. *Science, 333*(6045), 1024-1026.

Chornesky, E.A., A.M. Bartuska, G.H. Aplet, K.O. Britton, J. Cummings Carlson, F.W. Davis, J. Eskow, D. Gordon, K. Gottschalk, R. Hacck, A. Hansen, R. Mack, F. Rahel, M. Shannon, L. Wainger and T.B. Wigley 2005. Science Priorities for Reducing the Threat of Invasive Species to Sustainable Forestry. *Bioscience, 55*(4), 335-348.

Clavero, M. L. Brotons, P. Pons, D. Sol. 2009. Prominent Role of Invasive Species in Avian Biodiversity Loss. *Biological Conservation, 142*(10), 2043-2049.

Climate Change Resource Center (CCRC) .2012. *Climate Change Primer*. Retrieved June 26, 2013, from http://www.fs.fed.us/ccrc/climate-basics/climate-primer.shtml

Climate Impacts Group (CIG). 2008. *Climate Change Scenarios*. Retrieved June 27, 2013, from http://cses.washington.edu/cig/fpt/ccscenarios.shtml

Cochrane, A. (Botanist/Ecologist). 2014. Personal Communication to Diane Schuldt, USDA Forest Serivice Regarding Population Occurrences of SCNF Sensitive Plants. Email Communication, December 6, 2014.

Colbor, T. and P. Short. 1999. Pesticide Use in the U.S. and Policy Implications: A Focus on Herbicides. *Toxicology and Industrial Health, 15*(1-2), 241-276.

Connelly, J.W., M.A. Schroeder, A.R. Sands, and C.E. Braun. 2000. Guidelines to manage sage grouse populations and their habitats. *Wildlife Society Bulletin, 28*(4), 967-985.

Corbin, J. and C. D'Antonio. 2012. Gone But Not Forgotten-Invasive Plant Legacies on Community and Ecosystem Properties. *Invasive Plant Science and Management, 5*(1), 117-124.

Council on Environmental Quality . 2012. 40 Code of Federal Reulations 1502 Environmental Impact Statement. 981-988.

Crone, E.E., M. Marler, and D.E. Pearson. 2009. Non-target effects of broadleaf herbicide on a native perennial forb: a demographic framework for assessing and minimizing impacts. *Journal of Applied Ecology, 46*(3), 673-682.

Cusak, C. M. Harte, and S. Chan. 2009. *The Economics of Invasive Species.* Prepared by the Oregon Sea Grant for the Oregon Invasive Species Council. Retrieved from Grant of the Oregon Invasive Species Council: http://seagrant.oregonstate.edu/sgpubs/onlinepubs.htm

Davis, M. 2013. *Initial Effects of Imazapic on Cheatgrass, Native Grasses and Forbs.* SageSTEP News, Issue 22. Retrieved from http://sagestep.org/pdfs/newletter/SageSTEP_News_Issue_22.pdf

Davis, M. 2014. *Cheatgrass Control with Imazapic: What Influences Success and What are the Side Effects.* SageSTEP News, Issue 12 . Retrieved from http://sagestep.org/pdfs/newsletter/SageSTEP_News_Issue_23.pdf

Dawson, F.H. and D. Holland. 1999. The Distribution in Bankside Habitats of Three Alien Invasive Plant in the U.K. in Relation to the Development of Control Strategies. *Hydrobiolgia, 415*(1999).

Dent, L. and J. Robben. 2000. *Oregon Department of Forestry Aerial Pesticide Application Monitoring Final Report.* Oregon Department of Forestry, Forest Practices Monitoring Programs, Technical Report 7.

Dewey, S., M. Jenkins and R. Tonioli. 1995. Wildfire Suppression-A Paradigm for Noxious Weed Management. *Weed Technology, 9*(3), 627-627.

Dexter, A. 1993. *Herbicide Spray Drift.* Retrieved from North Dakota State Univeristy Extension Service : http://www.agndsu.edu/pubs/plantsci/weeds/a657w.htm

DiTomaso, J.M., J.R. Miller, G.B. Kyser, A.W. Hazebrook, J. Trumbo, D. Balcore, and V.F. Carrithers. 2004. Aerial Application of Clopyralid Demonstrates Little Drift Potential and Low Toxicity to Toads. *California Agriculture, 58*(3), 154-158.

Dodson, E. 2004. *Monitoring Change in Exotic Plant Abundance After Fuel Reduction Treatments in Ponderosa Pine Forests of Western montana .* MS Thesis, Trevecca Nazarene University.

Dow AgroSciences. 1997. Clopyralid: A North American Technical Profile. . Indianapolis, IN. 32 pp.

Dow AgroSciences. 2005. Aminopyralid Technical Bulletin .10 pp.

Dow AgroScience. 2009. Tordon 22K (Picloram) Specimen Herbicide Label. Avaliable online at www.cdms.net, accessed on July 22, 2014.

Dow AgroSciences. 2011a. Transline (Clopyralid) Specimen Herbicide Label. Avaliable online at: www.cdms.net, accessed July 22, 2014.

Dow Agrosciences. 2011b. Garlon 3A (Triclopyr) Specimen Herbicide Label. Available online at: www.cdms.net, accessed July 22, 2014.

Dow AgroSciences. 2013. Milestone (Aminopyralid) Specimen Label. Avaliable online at www.cdms.net, accessed July 22, 2014.

Dukes, J. and H. Mooney. 1999. Does Global Change Incres the Success of Biological Invaders? *Trends in Ecology and Evolution, 14*(4), 135-139.

Duncan, C. A. Kulla and M. Halvstedt. 2008. Effect of Aminopyralid on Non-Target Vegetation Following Aerial Applications. *Proceedings for the Western Soceity of Weed Science*, *61*, pp. 34-35.

Duncan, C., J. Story, and R. Sheley. 2005. *Montana Knapweeds: Identification, Biology and Management.* Bozeman, Montana: Montana State University, Montana State University Extension Service.

Duncan, C.A., J.J. Jachetta, M.L. Brown, V.F. Carrithers, J.K. Clark, J.M. DiTomaso, R.G. Lym, K.C. McDanial, M.F. Renz, and P.M. Rice. 2004. Assessing the Economic, Environmental, and Societal Losses from Invasive Plants and Ragelands and Wildlands. *Weed Technology, 18*(1), 1411-1416.

DuPont . 2013. Oust XP (Sulfometuron methyl) Specimen Herbicide Label .

DuPont. 2009. DuPont Excort XP Herbicide label. 16 pp. .

DuPont. 2011. DuPont Telar XP Herbicide Label. 15 pp. .

Earle, B. and S. Earle. 2012 Idaho Mountain Wildflowers: Payosn's Draba (Draba paysonii) and Stanley Creek Draba (*Draba trichocarpa*). Avalible online at: http://www.larkspurbooks.com/index/html. Accessed December 2, 2014.

Erhenfeld, J. 2003. Effects of Exotic Platn Invasions on Soil Nutrient Cycling Procesesses. *Ecosystems, 6*(6), 503-523.

Eiswerth, M.E. and T.D. Darden, W.S. Johnson, J. Agapoff and T.R. Harris. 2005. Input-output modeling, outdoor recreation, and the economics of weeds. *Weed Science, 53*(1), 130-137.

Eke, T. 1997. Euphorbia sap keratouveitis. *British Journal of Ophthalmology, 81*(6), 518.

Eliasson, L. 1972. Responses of Populus tremula to Picloram and other Translocated Herbicides. *Physiologia Plantarum, 27*(2), 101-104.

Elliot, W.J., and D.E. Hall. 2010. Disturbed WEPP Model 2.0 Ver. 2013.07.01. Moscow, Idaho: U.S. Department of Agricutlure, Forest Service, Rocky Mountain Research Station. Retrieved from http://forest.moscowfsl.wsu.edu/fswepp

Ellis, L. 1995. Bird use of Salt Cedar and Cottonwood Vegetation in the Middle rio Grande Valley of New Mexico. *Journal of Arid Environments, 30*(3), 339-349.

Elzinga, C. 1997. *Habitat Conservation Assessment and Conservation Strategy for Lemhi Penstemon.* U.S. Department of Agricuture, Forest Service and Department of Interior, Bureau of Land Management.Salmon, Idaho. 68 pp.

Estes-Zumph, W. n.d. Post-doctorate student, University of Idaho, Personal Communication. Moscow, Idaho .

Evans, R. and J. Young. 1975 Aerial Application plus Picloram for Green Rabbitbrush Control. *Journal of Range Management.*28(4): 315-318.

Evans, R.A., J.A. Young and R.E. Eckert, Jr. 1981. The Application and Use of Herbicides for Brush and Weed Control. *Managing Intermoutain Rangelands, Symposium Proceedings*, (pp. 32-38). Twin Falls, Idaho.

Executive Order 12898. 1994. Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations. *Federal Register, 59*(32).

Executive Order 131112. 1999. Invasive Species. *Federal Register, 64(25)*, 6183-6186.

Executive Order 13186. 2001. Responsibilities of Federal Agencies to Protect Migratory Birds. *Federal Register, 66*, 3853-3856.

Executive Order. 13175. Consultation and Coordination With Indian Tribal Governements. November 6, 2000.

Executive Order 13693. 2015. Planning for Federal Sustainability in the Next Decade. Federal Register, 80(57):15871-15884.

Extoxnet. 1993. *Movement of Pesticides in the Environment.* Retrieved from Extention Toxicology Network Toxicology Informaiton Briefs: http://extoxnet.orst.edu/tibs/movements.htm

Federal Insecticide, Fungicide, and Rodenticide Act. 1947. As Ammended through P.L. 112-177, Effective Sept. 28, 2012.

Felsot, A. 2001. Assessing the Safety of Herbicides for Vegetation Management in the Missoula Valley Region: A Question and Answer Guide to Human Health Issues. *Prepared on Behalf of the Missoula Valley Weed managers*, 45 pp. . Missoula, Montana.

Ferguson, L., C. Duncan, K. Snodgrass. 2003. *Backcountry Road Maintenance Weed Management.* Missoula, Montana: U.S. Department of Agriculture, Forest Service Technology and Development Program.

Fowlkes, M.D., J.L. Michael, T.L. Crisman, and J.P. Prenger. 2003. Effects of the herbicide imazapyr on benthic macroinvertebrates in a logged pond cypress dome. *Environmental Toxicology and Chamistry, 22*(4), 900-907.

Gelbar, J. and J. Belnap. 2003. Roads as Conduits for Exotic Plant Invasions in a Semiarid Environment. *Conservation Biology, 17*(2), 420-432.

Gilbert, B. and J.M. Levine. 2012. Plant invasion and extinction debts. *Proceedings of the National Academy of Sciences, 110*(5), 1744-1749.

Gluns, D. 1989. *Herbicide Residue in Surface Water Following an Application of Roundup in the Revelstoke Forest District.* Nelson, B.C.: B.C. Ministry of Forests and Lands.

Goodwin, K., G. Marks, and R. Sheley. 2006. *Revegetation Guidelines for Western Monanta: Considering Invasive Weeds.* Missoula, Montana: Montana State University Extension and Missoula County Weed District.

Gratkowski, H. 1977. Seaonsl Effects of Phenoxy herbicides on Ponderosa Pine and Associated Brush Species. *Forest Science, 23*(1), 2-12.

Gratkowski, H. 1978. Annual variation in Effect of 2,4,-D and 2,4-T on Ponderosa Pine. *Forest Science, 24*(2), 281-287.

Guo, Q., D.F. Sax, H. Qian and R. Early. 2012. Latitudinal shifts of introducted species: possible causes and implications. *Biological Invasions, 14*(3), 547-556.

Guyton, Kathryn Z., et al. 2015. Carcinogenicity of tetrachlorvinphos, parathion, malathion, diazinon, and glyphosate. Lancet Oncology. Published online March 20, 2015. http://www.thelancet.com/pdfs/journals/lanonc/PIIS1470-2045%2815%2970134-8.pdf. Accessed online on 05/26/15.

Haas, R.H., C.J. Scifres, M.G. Merkle, R.R. Hahn, G.O. Hoffman. 1971. Occurrence and Persistence of Picloram in Grassland Water Sources. *Weed Research, 11*(1), 54-62.

Halstvedt, M. and P. Rice. 2009. Plant Community Response to Aminopyralid. *Proceedings for the Western Society of Weed Science, 62*, 41-42.

Halstvedt, M., D. Cummings, T. Almquist, L. Samuel, R. Lym, G. Beck, R. Becker, C. Duncan, R. Sheley. 2010. Native Forb and Shrub Tolerance to Milestone Herbicide. *TechLine News*. August 1, 2010, 4 pp.

Harris, P. 1991. Classical biocontrol of weeds: Its definitions, selcetion of effective agents, and administrative-political problems. *The Canadian Entomologist, 123*, 827-849.

Harrod, R. 2001. Effects of Invasive and Noxious Plants on Land Management in Oregon and Washington. *Northwest Science, 75*, 85-90.

Hellmann, J.J., J.E. Byers, B.G. Bierwager, and J.S. Dukes. 2008. Five potential consequences of climate change for invasive species. *Consevation Biology, 22*(3), 534-543.

Heyerdahl, E.K., R.F. Milles, and R.A. Parsons. 2006. History of fire and Douglas-fir establishment in a savanna and sagebrush-grassland mosaid, southwestern Montana, USA. *Forest Ecology and Management, 230*(2006), 107-118.

Hickenbottom, J. 2000. *A comparative analysis of surface erosion and water runoff from existing and re-contoured Forest Service roads: O'Brien-Watershed, Lolo National Forest, Montana.* Missoula, Montana: M.S. Thesis, University of Montana.

Heidel, B. and J.S. Shelly. 2001. *The Effects of Fire on Lemhi Penstemon: Final Monitoring Report, 1995-2000.* Helena, Montana: Report to the Beaverhead-Deerlodge national Forest and the Dillon field Office-Burearu of Land Management. Montana Natural Heritage Program.

Hierro, J. R. 2003. Allelopathy and exotic plant invasion. *Plant and Soil, 256* (1), 29-39.

Hoag, C.J., L. St. John, and D.G. Ogle. 2001. *Reading Seed Packaging Labels and Calculating Seed Mixtures.* Boise, Idaho: USDA-Natrual Resources Conservation Service.

Idaho Conservation Data Center. 2008. TES species GIS data. Idaho Department of Fish and Game, Boise, Idaho. Updated February 2008. Available on the S-CNF corporate GIS database.

Idaho Department of Environmental Quality. 2012. Idaho Administrative Practices Act (IDAPA) 58, Title 01, Chapter 02, Water Quality Standards.

Idaho Department of Environmental Quality .2014a. *Idaho's 2012 Integrated Report, Final .* Boise, Idaho : State of Idaho, Department of Environmental Quality

Idaho Department of Environmental Quality. 2014b. Source Water Assessment Database. Accessed February 2014 at http://www2.deq.idaho.gov/water/swaOnline.

Idaho Department of Fish and Game (IDFG). 2010. *Bighorn sheep managment plan 2010.* Boise, Idaho: Idaho Department of Fish and Game.

Idaho Department of Fish and Game and Nez Perce Tribe. 2014. *2013 Idaho wolf monitoring progress report.* Idaho Department of Fish and Game, Boise, Idaho and Nez Perce Tribe Wolf Recovery Project, Lapwai, Idaho.

Idaho Department of Water Resources. 2014a. *Drought Emergency Declarations website.* Retrieved January 31, 2014, from www.idwr.idaho.gov/News/drought/drought.htm

Idaho Deparment of Water Resources. 2014b. *Average Annual Precipitation, State of Idaho, Data from PRISM Climate Group, 30-year normals 1981-2010.* Retrieved February 11, 2014, from http://www.idwr, idaho.gov/WaterInformation/WaterSupply/images/id_precip.gif

Idaho Invasive Species Council Technical Committee. 2007. *Idaho Aquatic Nuisance Species Plan, A Supplement to Idaho's Strategic Action Plan for Invasive Species.* Prepared for Governon C.L. "Butch" Otter and the Idaho Invasive Species Council by the Idaho Invasive Species Council Technical Committee. Retrieved from http://fishandgame.idaho.gov/public/fish/plantAquaticNuisance.pdf

Idaho Partners in Flight. 2000. *Idaho bird conservation plant, version 1.0.* Boise, Idaho: Idaho Partners in Flight.

Idaho State Department of Agriculture. 2003. IDAPA 02.03.03-Idaho Department of Agriculture Rules Governing Pesticide and Chemigation Use and Application. 33 pp. .

Idaho State Department of. Agriculture. 2003. *Idaho Invasive Species Strategic Plan.* Retrieved from http://www.idahoag.us/Catagories/PlantsInects/NoxiousWeeds/indexnoxweedmain.php

Idaho State Department of Agriculture. 2014. Noxious weed FAQs. 5 pp. . Avaliable online.

Idaho State Department of Agriculture. 2015. Idaho's 65 Noxious Weeds. Available online at: http://www.agri.state.id.us/Categories/PlantsInsects/NoxiousWeeds/watchlist.php, accessed on January 5, 2015.

Information Ventures, Inc. 2002. *Environmental Health Clearinghourse.* Pesticide Facts Sheets. Retrieved June 2, 2002, from http://infoventures.com/e-hlth/pesticide/pes-fac.html

Information Ventures, Inc. 2003. *Metsulfuron methyl pesticide fact sheet.* Prepared for the USDA Forest Service. Retrieved from http://infoventure.com/ehlth/pesticide/metsulf.html

Jankovsky-Jones, M. 1999. Conservation Strategy for Westlands in East Central Idaho. Idaho Deparmtne of Fish and Game. Boise, Idaho: Idaho Department of Fish and Game, Idaho Conservation Data Center. 273 pp.

Junk, W.J., and P.B. Bayley, and R.E. Sparks. 1989. The flood pulse concept in river floodplain systems. In D. Dodge (Ed.), *Proceeding of the International Large River Symposium, Canadian special publication of fisheries and aquatic sciences* (Vol. 106, pp. 110-127).

Kardol, P. and D. Wardle. 2010. How understanding aboveground-belowground linkages can assist resotration ecology. *Trends in Ecology and Evolution, 25*(11), 670-679.

Kegley, S.E., K.A. Tupper, K.R. Mills, F.M. Kaser, E. Stove, A. C-K. Wang, A.M. Wu,C. Dansereau, S. Bjorkvist, S. Jim, T. Brown, C. Reardon, C. Vazquez and J.J. Epps. 2009. *Community based environmnetal monitoring of airborn pesticides: volatilization derift of semi-volatile pesticides as a contributor to bystander pesticide exposure.* Berkeley, California: Pesticide Research Institute.

Kerns, B. and Guo, Q. 2012. *Climate Change and Invasive Plants in Forests and Rangelands.* Retrieved from U.S. Department of Agriculture, Forest Service, Climate Change Resrouce Center: http://www.fs.fed.us/ccrc/topics/invasive-plants/index.shtml

Kerns, B., W. Thies, and C. Niwa. 2006. Season and Severity of Prescribe Burn in Ponderosa Pine Forests-Implications for Understory Native and Exotic Plants. *EcoScience, 13*(1), 45-55.

Kilronomos, J. 2002. Feedback with soil biota contributes to plant rarity and invasiveness in communities. *Nature, 417*(6884), 67-70.

Kilroy, B., D. Karsky and H. Thistle. 2003. *Aerial Application Equipment Guid 0E02P44 .* USDA Forest Serive FHTET-0302.

Kinter, C., B. Mealor, N. shaw and A. Hild. 2007. Post-fire invasion potential of rush skeletonweed. *Rangeland Ecology and Managment, 60*(4), 386-394.

Knick, S.T., D.S. Dobkin, J.T. Toenberry, M.A. Schroeder, W.M. Vander Haegern and C Van Riper III. 2003. Teetering on the edge or too late? Conservation and research issues for avifauna of sagebrush habitats. *The Condor, 105*(4), 611-634.

Lacey, J.R., C.B. Marlow and J.R. Lane. 1989. Influence of spotted knapweed (Centaurea maculosa) on surface water runoff and sediment yield. *Weed Technology, 3*.

Lacey, J., P. Husby, and G. Handl. 1990. Observations on spotted and diffuse knapweed invasion into ungrazed bunchgrass communities in Western Montana. *Rangelands, 12*(1), 30-32.

Ladyman, J.A.R. 2004. *Draba globose* Payson (beavertip draba): A Technical Conservation Assessment. Centennial, CO: U.S. Deparment of Agriculture, Forest Service, Rocky Mountain Region, Species Conservation Project. 43 pp.

Lajmanovich, R.C., C.M. Junges, A.M Attademo, P.M. Peltzer, M.C. Cabagna-Zenklusen, and A. Basso. 2013. Individual Mixture Toxicity of Commercial Formulations Containing Glyphosate, Metsulfuron-Nethyl, Bispyribac-Sodium and Picloram on Rhinella arenarum Tadpoles. *Water, Air and Soil Pollution, 224*(3), 1-13.

Lautenschlager, R.A. and T.P. Sullivan. 2004. Improving research into effects of forest herbicide use on biota in northern ecosystems. *Wildlife Society Bulletin, 32*(4), 1061-1070.

Leger, E. 2008. The adaptive value of remnant native platns in invaded communities-an example from the Great Basin. *Ecological Applications, 18*(5), 1226-1235.

Leistritz, F.L., and D.A. Bangsund, and N.M Hodur. 2004. Assessing the Economic Impact of Invasive Weeds: The Case of Leafy Spurge (Euphorbia esula). *Weed Technology, 18*(sp 1), 1392-1395.

LeJeune, K.D. and T.R. Seastedt. 2001. Centaurea Species-Thr Forb that Won the West. *Conservation Biology, 15*(6), 1568-1574.

Leonard, R.A., W.G. Knisel, and D.A. Still. 1987. GLEAMS: Groundwater Loading Effects of Agricultural Management Systems. *Trans. ASAE, 30*(5), 1403-1418.

Lesica, P. and J.S. Shelly. 1996. Competitive Effects of Centaurea maculosa on the Population Dynamics of Arabis fecunda. *Bulletin of the Torrey Botanical Club, 123*(2), 111-121.

Levine, J.M., M. Vila, C.M. D'Antonio, J.S. Dukes, K. Grigulis and S. Lavorel. 2003. Mechanisms underlying the impacts of exotic plant invasions. *Proceedings of the Royal Society of London. Series B: Biological Sciences, 270*(1517), 775-781.

Lincoln County Weed Board. unknown. Herbicide Facts pamphlet. 43 pp.

Lym, R.G. and C.A. Duncan. 2005. Canada Thistle, Cirsium arvense. In C. D. Clark (Ed.), *Invasive Plants of Range and Wildlands and Their Environmental, Economic and Societal Impacts* (pp. 69-83). Lawerence, Kansas: Weed Science Society of America.

MacFarlane, B. 2012. *Gospatial Identification of Potnetial Waters of the United States (WOTUS) for the Salmon-Challis National Forest.* USDA Forest Service, Salmon-Challis National Forest.

Malick, S.L., J.G. Bruggink, and J.L. Belant. 2012. Effects of Forest Patch Characteristics on Small Mammal Species Composition, Grand Sable Dunes, Michigan. *Natural Ares Journal, 32*(3), 293-299.

Mancuso, M. 2006. *Updated Conservation Information for BLM Special Status Plant Occurrences in the Salmon Field Office Area.* Boise, Idaho: Idaho Conservation Data Center and Idaho Department of Fish and Game.

Marshall, J.S. and L.W. Vandrull. 2002. Impact of selective herbicide right-of-way vegetation treatment on birds. *Environmental Management, 30*(6), 801-806.

Martin, L.J. and B.R. Murray. 2011. A predictive framework and review of the ecological impacts of exotic plant invasions on reptiles and amphibians. *Biological Review, 86*(2), 407-412.

Massachusetts Dept. of Agricultural Resources (MDAR). 2004. Final Generic Environmental Impact Report, Appendix III. pp. 136-142. Available online: http://www.mass.gov/agr/pesticides/aquatic/docs/Adjuvants.pdf

Masters, R., and R. Sheley. 2001. Principles and Practices for Managing Rangeland Invasive Plants. *Journal of Range Management, 54*(5), 502-517.

Mathews, S. 1989. *Sensitive Plant Surveys: U.S. Forest Service, Region 1, Gallatin National Forest, Montana.* Helena, Montana: Montana National Heritage Program.

Matz, S. 1995. *Salmon National Forest Research Design Methodology.* Report Number SL-9491034, On File at the Salmon-Challis ntioanl Forest, Salmon, Idaho.

Mayer, F.L. and M.R. Ellersieck. 1986. *Manual of acute toxicity: interpretation and data base for 410 chemicals and 66 species of freshwater animals.* USDI Fish and Wildlife Service.

Mazzola, M. J. Chambers, R. Blank, D. Pyke, E. Schupp, K. Allcock, P. Doescher, and R. Nowak. 2010. Effects of resource availability and propagule supply on native species recruitment in sagebrush ecosystems invaded by Bromus tectorum. *Biological Invasions, 13*(2), 513-526.

McBroom, M.W., J. Louch, R.S. Beasley, M. Chang, G.G. Ice. 2013. Runoff of Silvicultural Herbicides Applied Using Best Management Practices. *Forest Science, 59*(2), 197-210.

McEvoy, P. and E. Coombs. 1999. Biological Control of Plant Invader: Regional Patterns, Field Experiments and Structured Population Models. *Ecological Applications, 9*(2), 387-401.

Mealor, B. and A. Hild. 2007. Post-Invasion Evolution-of-Native Grass Populations: A Test of Biological Resilience. *Oikos , 166*(9), 1493-1500.

Mealor, B., and A. Hild. 2006. Potential Selection in Native Grass Populations by Exotic Invasion. *Molecular Ecology, 15*(8), 2291-2300.

Menalled, F. and W.E. Dyer. 2005. *Getting the most from soil-applied herbicides.* Montana State University Extnesion Service.

Menalled, F. Unknown.Weed management in changing climate. Montan State University, Missoula, Montana. Powerpoint presentation. 41 pp.

Mickelson, J. R. Lym. 2013. Effect of aminopyralid on desirable forb species. *6*(1), 30-35.

Miller, P. and P. Westra. 1998. How surfactants work. Colorado State University Coop. Extension. Bulletin No. 0.564. 3pp.

Mills, G. J. 1989. Effects of urbanization on breeding bird community structure in sourthwestern desert habitats. *The Condor, 91*(2), 416-428.

Monsen, S. R. 2004. *Restoring Western Ranges and Wildlands* (Vols. General Technical Report RMRS-GTR-13, Volume 1). USDA Forest Service, Rocky Mountain Research Station.

Montana Natural Heritage Program. 2008. *Montana Field Guide-Linear Moonwort.* Retrieved 2014, from http://mtnhp.org/plants/

Morgan, V.H. and K. Patten. 2012. Aquatic Weed Control. In E. Peachey (Ed.), *Pacific Northwest Weed Management Handbook* (pp. J1-J14). Corvallis, Oregon: Oregon State University.

Morin, L., A. Reid, N. Sims-Chilton, Y. Buckley, K. Dhileepan, G. Hastwell, T. Nordblom and S. Raghu. 2009. Review of approaches to evaluate the effectiveness of weed biological control agents. *Biolgoical Control, 51*(1), 1-15.

Morrison, M.L. and E.C. Meslow. 1984. Effects of the herbicide glyphosate on bird community structure, western Oregon. *Forest Science, 30*(1), 95-106.

Mosely, R. 1988. *Field Investigations of Three Sensitive Plant Species Endemic to the Stanley Basin Area-Draba trichocarpa, Thlapsi aileeniae, and Eriogonum meledonum.* Boise, Idaho: Idaho Department of Fish and Game.

Moseley, R. 1989. *Field Investigation of Four Astragali on the Salmon National Forest.* Boise, Idaho: Idaho Department of Fish and Game, Natural Heritage Section, Nongame Wildlife/Endangered Species Program. 24 pp.

Mueggler, W. and W. Stewart. 1981. Forage Production on Important Rangeland Habitat Types in Western Montana. *Journal of Range Management, 34*(5), 347-353.

Murphy, C. 2002. *The Stauts of Welsh's Buckwheat (Eriogonum capistratum Var. Welshii) in Idaho.* Boise, Idaho: Idaho Department of Fish and Game.

Murphy, M.L. and W.R. Meehan. 1991. Stream Ecosystems. In *Influences of Forest and Rangeland Management on Salmonid Fishes and Their Habitats* (pp. 17-44). Bethesda, Maryland: American Fisheries Society Special Publication 19.

Myers, J. M. 2004. Invasive plants: their impacts and control in changing environments. In T. Hooper (Ed.), *Proceedings of the Species at Risk 2004 Pathways to Recovery Conference. 1 March 2-6, 2004*, (p. 6 pp.). Victoria, B.C.

National Council for Air and Stream Improvement, Inc. (NCASI). 2009. *Forest Herbicide Effects on Pacific Northwest Ecosystems: A Literature Review* . Research Triangle Park, North Carolin: National Council for Air and Stream Improvement, Inc. .

National Forest System Invasive Species management. 2014. *National Forest System Invasive Species Management Record Keeping Business Rules and National Standars (v01.10.2014).*

National Invasive Species Council. 2008. 2008-2012 National Invasive Species Management Plan. 35 pp. .

National Invasive Species Council. 2001. *Meeting the Invasive Species Challenge: National Invasive Species Management Plant.*

National Marine Fisheries Service (NMFS). 2012. *Endangered Species Act Section7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation.* Reinitiation for the Effects of the Salmon, Challis National Forest Noxious Weed Management Program (non-wilderness areas) in the Upper Salmon River (170602) Basin, Lemhi, and Custer Counties, Idaho. NMFS Consultation Number 2012/02030.

National Wildfire Coordination Group. 2013. *Interagency Helicopter Operations Guide.*

National Wildfire Coordinating Group. 2014. *Interagency prescribed Fire Planning and Implementation Procedures Guide. PMS 484.*

NatureServe. 2008. *NatureServe: An online encyclopedia of life [web application] Version 7.0*. (A. V. NatureServe, Producer) Retrieved May 18, 2008, from http://www.natureserve.org/explorer

NatureServe. 2009. *NatureServe Explorer: An online encyclopedia of life [web application] Version 7.1*. (A. V. NatureServe, Producer) Retrieved February 2009, from http://www.natureserve.org/explorer

NatureServe. 2011. *NatureServe Explorer: An online encyclopedia of life [web application] Version 7.1*. (A. V. NatureServe, Producer) Retrieved from http://www.natureserve.org/explorer

NatureServe. 2012.*NatureServe Explorer: An online encyclopedia of life [web application] Version 7.1*. (A. V. NatureServe, Producer) Retrieved from http://www.natureserve.org/explorer

NatureServe. 2013. *NatureServe Explorer: An online encyclopedia of life [web application] Version 7.1*. (A. V. Nature Serve, Producer) Retrieved from http://www.natureserve.org/explorer

NatureServe. 2014. NatureServe Explorere: An online encyclopedia of life [web application]. Verstion 7.1. Nature Serve, Arlington, Viginia. Available at: http://www.natureserve.org/explorer. Accessed December 2, 2014.

Neary, D.G. and J.L. Michael. 1996. Herbicides-Protecting long-term sustainability and water quality in forest ecosystems. *NewZealand Jornal of Forestry Science, 26*(1/2), 241-264.

Nelson, R. M. 1991. Mining. In W. Meehan (Ed.), *Influences of Forest and Rangeland Management on Salmonid Fishes and Their Habitats* (pp. 425-458). Bethesda, Maryland: American Fiseries Society Special Publication 19.

Newton, M. 1963. Some Herbicide Effects on Potted Douglas-fir and ponderosa Pine Seedlings. *Journal of Forestry, 61*(9), 674-676.

Newton, M. B. 2013. Forestry. In E. Peachey (Ed.), *Pacific Northwest Weed Management Handbook* (pp. K1-K19). Corvallis, Oregon: Oregon State University. Retrieved from http://pnwhandbooks.org/weed/

Nez Perce Bio-Control Center.2012. Lapwai, Idaho. Retrieved from http://www.nezpercebiocontrol.com

Nice, G. B. 2004. Amine or ester, which is better? 5 pp. . Purdue Extension Weed Science. WS-31-W.

Norris, L.A., and H.W. Long, S.V. Gregory. 1983. *Influence of Forest and Rangeland Management on Anadromous Fish habitat in Western north America. 9 Forest Chemicals.* Portland, Oregon: USDA Forest Service, Pacif Northwest forest and Range Experiment Station, General Technical Report PNW-149.

Norris, L.A., H.A. Lorz and S.V. Gregory. 1991. Forest Chemicals. In W. Meehan (Ed.), *Influences of Forest and Rangeland Management on salmonid Fishes and Their Habitats* (pp. 139-179). Bethesda, Maryland: American Fisheries Society Special Publication 19.

Nufarm. 2010. Weedar 64 (2,4-D) Specimen Herbicide label.

Nufarm. 2011a. Aqua Neat (Glyphosate) Speciment Herbicide Label .

Nufarm. 2011b. Banquish (Dicamba) Speciment Herbicide Label .

Office of the Federal Register . 1991. Vol 56, No. 224. Wednesday, November 20, 1991. Endangered and Threatened Species. Endangered Status for Snake River Sockeye Salmon. *50 CFR, Pt 222*.

Office of the Federal Register . 1992. Vol 57, No. 78. Wednesday, April 22, 1992. Endangered and Threatened Species. Threatened Status for Snake River Spring/Summer Chinook Salmon . *50 CFR, Pt 227*.

Office of the Federal Register . 1993. Vol 58, No. 247. Tuesday, December 28, 1993. Designated Critical Habitat Snake River Sockeye Salmon, Snake River Spring/Summer Chinook Salmon and Snake River Fall Chinook Salmon. *50 CFR, Pt 226*.

Office of the Federal Register . 1997. Vol 62, No. 159. Monday, August 18, 1997. Endangered and Thrreatened Species. Listing of Severl Evolutionary Signigcant Units (ESUs) of west Coast Steelhead . *50 CFR Pts 222 & 227*.

Office of the Federal Register . 1998. Vol 63, No. 111. Wenesday, June 10, 1998. Endangered and Threatened Wldlife and Plants. . *Determination of Threatened Status for the Klamath River Population Segment of Bull Trout as an Endangered Species and Columbia River population Segment of Bull Trout as a Treatened Species. 50 CFR, Pt. 17*.

Office of the Federal Register . 1999. Vol 64, No. 205. Wednesday, October, 25, 1999. Designated Critical Habitat. Revision of Critical Habitat for Snake river Spring/Summer Chinook Salmon . *50 CFR, Pt. 227*.

Office of the Federal Register . 2005. Vol. 70, No. 170. Friday, September 2, 2005. Designated Critical Habitat Critical Habitat for 19 Evolutionary Significant Units of Salmon and Steelhead in Washinton, Oregon, Idaho and California . *50CFR, Pt 226*.

Oklahoma Cooperative Extension Service. Unknown. *Herbicide How-to: Understanding herbicide mode of action. PS-2778.*

Olson, B. 1999. Impacts of Noxious Weeds on Ecologic and Economic Systems. *Biology and Management of Noxious Rangeland Weeds*, 4-18 . (Sheley, R.L. and J.K. Petroff, Ed.) Corvallis, Oregon : Oregon State University Press.

Ortega, Y.K. and D.E. Pearson. 2005. Week versus Strong Invaders of Natural Plant Communities-Assessing Invasibility and Impact. *Ecological Applications, 15*(2), 651-661.

Ortega, Y.K. and D.E. Pearson. 2011. Long-Term Effects of Weed Control With Picloram Along a Gradient of Spotted Knapweed Invasion. *Rangeland Ecology and Management, 64*(1), 67-77.

Ortega, Y.K. and K.S. Mckelvey. 2006. Invasion of an exotic forb impacts reporductive success and site fidelity of a migratory songbird. *Oecologia, 149*(2), 340-351.

Ortega, Y.K., D.E. Pearson and K.S. McKelvey. 2004. Effects of Biological Control Agents and Exotic Plant Invasion on Deer Mouse Populations. *Ecological Applications, 14*(1).

Ostoja, S.M. and E.W. Schupp. 2009. Conversion of sagebrush shrublands to extoic annual grasslands negatively impacts small mammal communities. *Diversity and Distributions, 15*(5), 863-870.

Pacific Northwest Economic Region invasive Species Working Group. 2012. *Economic impacts of invasive species in the Pacific Northwest Economic Region.* Unpublished Report.

Paige, C. and S.A. Ritter. 1999. *Birds in sagebrush sea: managing sagebrush habitats for bird communities.* Boise, Idaho: Partners in Flight Western Working Group.

Parkinson, H., J. Mangold, J. Jacobs, J. Madsen and J. Halpop. 2011. *Biology, Ecology and Management of Eurasion Watermilfoil (Myriophyllum spicatum L.) .* Montana State University Extension EB0193, reprinted April 2011.

Parks, C.G., S.R. Radosevich, B.A. Endress, B.J. Naylor, D. Anzinger, L.J. Rew, B.D. Maxwell and K.A. Dwire. 2005. Natural and Land Use History of the Northwest Mountain ecoRegions (USA) in Relation to Patterns of Weed Invasion. *Perspectives in Plant Ecology Evolutions and Systematics, 7*(3), 137-158.

Pearson, D. and R. Callaway. 2003. Indirect Effects of Host-Specific Biolgical Control Agents. *Trends in Ecology and Evolution*, 456-461.

Pearson, D. and Y. Ortega. 2009. Managing Invasive Plants in Natural Areas: Moving Beyond Weed Control. In R. Kingely (Ed.), *Weeds: Management, Economic Impacts and Biology* (pp. 1-21). Nova Science Publishers.

Pearson, D., K. McKelvey and L. Reggiero. 2000. Non-Target Effects of an Introduced Biological Control Agent on Deer Mouse Ecology. *Oecologia, 122*(1), 121-128.

Pearson, D.E. 2009. Invasive Platn Architecture Alters Trophic Interactions by Changing Predator Abundance and Behavior. *Oecologia, 18*(9), 549-558.

Perkins, P.J., H.J. Boermans, and G.R. Stephenson. 2009. Toxicity of glyphosate and triclopyr using frong embryo teratogensis assay-Xenopus. *Environmental Toxicology and Chemistry, 19*(4), 940-945.

Perry, L. C. 2005. Screening of Grasslnd Plants for Resotration After Spotted Knapweed Invasion. *Resotration Ecology, 13*(4), 725-735.

Pesticide Management Education Program. 1985. *Chlorsulfuron herbicide profile*. (C. University, Producer) Retrieved from hattp://pmep.cce.cornell.edu/profiles/herb-growthre/cacodylic-cymoxanil/chlorsulfuron/chlsuf_prf_0385.html

Planty-Tabacchi, A.M., and E. Tabacchi, R.J. Naiman, C. Deferrari, and H. Decamps. 1996. Invasibility of Species-Rich Communities in Riparian Zones. *Conservation Biology, 10*(2), 598-607.

Poff, N.L., J.D. Allan, M.B. Bain, J.R. Karr, K.L. Prestegaard, B.D. Richter, R.E. Sparks, and J.C. Stromberg. 1997. The Natural Flow Regime. BioScience. 47(11): 769-784.

Pokorney, M. J. 2010. Managing Spotted Knapweed (*Centaurea stebe*)-Infested Rangeland after Wildfire. *Invasive Plant Science and Management, 3*(2), 182-189.

Pokorney, M., R. Sheley, C. Zabinski, R. Engel, T. Svejcar, and J. Borkowski. 2004. Plant Functional Group Diversity as a Mechanism for Invasion Resistance. *Resotration Ecology, 13*(3), 448-459.

Pokorney, M., R. Sheley, T. Svejcar, and R. Engel. 2004. Plant Species Diversity in a Grassland Plant Community: Evidence for Forbs as a Critical Management Consideration. *Western North America Naturalist, 64*(2), 219-230.

Pollnac, F., and L. Rew. 2013. Life After Establishment: Factors Structuring the Success of a Mountain Invader Away from Disturbed Roadsides. *Biological Invasions*, 10 pp. doi:10.1007/s10530-013-06 17-6

Polvi, L., E. Wohl, and D.M. Merritt. 2014. Modeling the Functional Invluence of Vegetation Type on Streambank Cohesion. *eath Surface Process. Landforms (2014)*. doi:10:.1002/esp.3577

Powell, R.A. and W.J. Zielinski. 1994. Fisher. In L. K. Ruggiero (Ed.), *The scientific basis for conserving forest carnivores: American marten, fisher, lynx and wolverin in the western United States* (pp. 38-73). USDA Forest Service, General Tehcnical Report RM-254.

Power, M. C. 2006. Fire and vegetation history during the last 3800 years in northwester Montana. *Geomorphology, 75*(3), 420-436.

Prather, T. 2007. Risk Assessment and Decision Making for Invasive Plant Management Planning. In: Invasive Plant Management, CIPM Online Textbook, Chapter 6 (12 pp). Missoula, MT: University of Montana, Center for Invasive Plant Management. Available online at http://www.weedcenter.org/textbook/index.html, accessed on January 14, 2015.

Prather, T. M. 2011. *Idaho's noxious weeds 2011 control guidelines for noncrop and rangeland sites.* University of Idaho Extension.

Prather, T. 2012. Weed control in noncropland right-of-way. In E. Peachey (Ed.), *Pacific Northwest Weed management Handbook* (pp. V1-V9). Corvallis, Oregon: Oregon State University.

Prather, T. 2013. Weed control in pasture and rangeland. In E. Peachey (Ed.), *Pacific Northwest Weed Management Handbook* (pp. U1-U10). Corvallis, Oregon : Oregon State University.

Public Law 100-4. 1987. Water Quality Act of 1987 (February 4, 1987)

Public Law 101-624. 1990. US Farm Bill, Title 14-Conservation, Sub-title D. 104 Stat. 3359 (November 28, 1990).

Public Law 101-549.

Public Law 106-224. 2000. Agriculture Risk Protection Act Titale IV-Plant Protetion Act.

Public Law 108-412, Noxious Weed Control and Eradication Acto of 2004. 118 Stat. 2320 (October 30, 2004).

Public Law 112-117. 2012. Federal Insecticide, Fungicide, and Rodenticide Act, as amended.

Public Law 89-655. 1966. The National Historic Preservation Act, as ammended in December 19, 2014.

Public Law 90-542. 1968. Wild and Scenic Rivers Act (October 2, 1968)

Public Law 90-583. 1968. Noxious Plant Control (Carson-Foley Act) .

Public Law 91-109. 1969. The National Environmental Policy Act.

Public Law 92-5000. 1972. Federal Water Pollution Control Act Amendments (Clean Water Act).

Public Law 93-629, Federal Noxious Weed Act of 1974. 88 Stat. 2148 (January 3, 1975).

Public Law 94-205 . 1973. Endangered Species Act.

Public Law 95-217. Clean Water Act (December 27, 1977)

Public Law 95-313. 1978. Cooperative Forestry Assistance Act (as amended through PL 110-246).

Pulbic Law . 1976. National Forest Management Act.

Purdue University.Unknown. *Herbicide Formulation Training*. (NRCA Undated Supplement) Retrieved from http://www.agriculture.purdue.edu/fnr/html/faculty/holt/NRCASupplement.pdf

Pyke, D. 2000. Proceedings Sagebrush Stepp Ecosystem Symposium. In P. A. Entwistle (Ed.), *Burearu of Land Management Publication No. BLM/ID?PT-001001+1150*, (p. 137 pp.). Boise, Idaho .

Quigley, T.M. and S.J. Arbelbide. 1997. An assessment of ecosystem components in the interior Columbia basin and portions of the Klamath and Great basins. Portland Oregion: USDA Forest Service, Pacific Northwest Research Station.

Rachael, J., ed. 2011. *Elk Study I Job 1. July 1, 2010 to June 30, 2011. Project W-170-R-34. Program Report.* Boise, Idaho: Idaho Department of Fish and Game.

Radosevich, S., E. Roncoroni, S. Conard and W. McHenry. 1980. Seasonal Tolerance of Six Confer Species to Eight Foliage-Active Herbicides. *Forest Science, 26*(1), 3-9.

Radosevich, S.R. and W.L Winterlin. 1977. Persistence of 2,4-D and 2,4,5-T in Chaparral Vegetation. *Soil and Weed Science, 25*(5), 423-425.

Ralphs, R. 1981. *Elk habitat relationships for central Idaho.* USFS Challis, Salmon and Sawtooth National Forests, USDA BLM Idaho Falls, Salmon and Shoshone Districts, and IDFG Regions 4 and 6 .

Randall, C. 2014. Personal Communication: Effectivness of Spotted Knapweed Root Weevil (Cyphocleonus achates) in Controlling Spotted Knapweed Infestations. September 11, 2014. 2 pp. .

Rashin, E. and C. Graber. 1993. *Effectiveness of best management practices for aerial application of forest pesticides.* Washington State Department of Ecology, Environmental Investigations and Laboratory Service Program, Watershed Assessments Section.

Reichard, S. and P. White. 2001. Horticulture as a pathway of invasive plant introductions in the United States: Most invasive plants have been introduced for horticultural use by nurseries, botanical gardens, and individuals. *BioScience, 51*(2), 103-113.

Reinhardt, C. 2000. Weed Management Practices in Natural Ecosystems: A Critical Review. *Koedoe, 43*(1), 67-74.

Renz, M. 2005. Perennial Pepperweed, Lepidium latifolium . In *Invasive Plants of Range and Wildlands and Their Environmental, Economic, Societal Impacts* (pp. 91-98). Lawerence, Kansas: Weed Science Society of America .

Reynolds, R. R. 1992. *Management recommendations for the northern goshawk in the southwestern United States. General Technical report RM-217.* Fort Collins, Colorado: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station .

Rice, P. 1990. *A risk assessment method to reduce picloram contamination of streams and groundwater from weed spraying projects .* Missoula, Montana: Division of Biolgocial Science, University of Montana .

Rice, P. D. 1992. *Plant Community Diversity after Herbicide Control of Spotted Knapweed. Research Paper INT-460.* Ogden, Utah: USDA Forest Service, Intermountain Research Station .

Rice, P. 1999. *The Magnitude of the Weed Invasion.* Retrieved from Invaders Database System-Summary of a detailed examination of verifiable distribution records in INVADERS from 1877 through 1977: http://invader.dbs.umt.edu

Rice, P. 2012. Herbicide Tolerance of Lemhi Penstemon. Unpublished Report Final Report PIAP Project Number R14-32 . 8 pp. .

Rice, P. n.d. Resotration of Native Plant Communities Infested by Invasive Weeds-Sawmill Creek Research natural Area. In H. Smith (Ed.), *The Bitterroot Ecosystem Management Project: What We Have Learned* (pp. 29-30). Missoula, Montana: Proceedings RMRS-P-17. USDA Forest Service, Rocky Mountain Research Station.

Rice, P. n.d. Winter Range Weed Treatment and Monitoring 2002-2012. Lolo National Forest .

Rice, P. 2013. Non-Target Forb Response to Spring-Applied Aminopyralid, PIAP Final Report, PIAP# R1/4-0210, Region 4 Grant #10-DG-11010000-015., (p. 41 pp.).

Rice, P. and M. Harrington. 2007. *Sawmill Research Natural Area Final Report: The Impact of Prescribed Fire Following Either Herbicide or Thinning Treatments on Bunchgrass and Forested Ecosystems in the Sawmill Creek RNA, Final Report May 15, 2007.* Bitterroot National Forest, Univeristy of Montana and USDA Forest Service Rocky Montain Research Station Fire Sciences Labe.

Rice, P. and J. Toney. 1996. Plant Population Responses to Broadcast Herbicide Applicatons for Spotted Knapweed Control. *Down to Earth, 51*(2), 14-19.

Rice, P.M. and J.C. Toney. 1998. Exotic Weed Control Treatments for Conservation of Fescue Grasslands in Montana. *Biolgocial Conservation, 85*(1998), 83-95.

Rice, P.M., J.C. Toney, D.J. Bedunah, and C.E. Carlson. 1997. Plant Community Diversity and Growth Form Responses to herbicide Applications for Control of Centaurea maculosa. *Journal of Applied Ecology, 34*(6), 1397-1412.

Riech, P. 2009. Elevated CO2 reduces losses of plant diversity caused by Nitrogen deposition. *Science, 326*(5958), 1399-1402.

Riley, C.M. and C.J. Wiesner. 1989. Off-target deposition and drift of aerially applied agricultural sprays. *Pesticide Science, 26*(2), 159-166.

Roadosevich, S. 2007. Plant Invasions and Their Management. In CIPM (Ed.), *Invasive Plant Management.* Bozeman, Montana : Center for Invasive Plant Management. Retrieved from http://www.weedcenter.org/textbook/index.html

Roberts, H. 2001. *Survey of pygmy rabbit distribution, numbers, and habitat use in Lemhi and Custer Counties, Idaho. Unpublished Report.* Salmon and Challis Bureau of Land Management Field Offices.

Rose, B. 2002. *Salmon-Challis National Forest Watershed Project Monitoring Results: Herbicide Drift Studies in the Spring Creek Watershed.*

Ruediger, B., J. Claar, S. Gniadek, B. Holt, L. Lewis, S. Mighton, B. Naney, G. Patton , T. Rinaldi, J. Trick, A. Vandehey, F. Wahl, N. Warren, D. Wenger, and A. Williamson. 2000. *Canada lynx conservation assessment and strategy.* Middoula, Montana: USDA Forest Service, USDI Fish and Wildlife Service, USDI Bureau of Land Management and USDI National Park Service.

Ruggiero, L.F., K.R. Aubry, S. Buskirk, G.M. Koehler,C.J. Krebs, K.S. McKelvey, and J.R. Squires. 1999. *Ecology and conservation of lynx in the United States. General Technical Report RMRS-GTR-30WWW.* Fort Collins, Colorado: US Department of Agriculture, Forest Service, Rocky Mountain Research Station. Retrieved from http://www.fs.fed.us/rm/pubs/rmrs_gtr30.html

Runyon, J. J. 2012. Invasive Species and Climate Change . In D. Finch, *Clminate change in grasslands, shrublands, and deserts of the interior American West: a review and needs assessment* (p. 139 pp.). Fort Collins, Colorado: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Ryan, M.G. and J.M. Vose. 2012. Effects of climatic variability and change. In J. D.-W. Vose, *Effects of climatic variability and change on forest ecosystems: a comprehensive science synthesis for the U.S. General Technical Report PNW-GTR-870* (pp. 7-95). Portland, Oregon: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station.

Sakai, A. F. 2001. The Population Biology of Invasive Specie. *Annual Review of Ecology and Systematics, 32*(2001), 305-332.

Samuel, L.W. and R.G. Lym. 2008. Aminopyralid effects on Canada thistle (Cirsium arvense) and native plant species. *Invasive Plant Science and Managment, 1*(3), 265-278.

Santillo, D. D. 1989. Responses of small mammals and habitat to glyphosate application on clearcuts. *Journal of Wildlife Management, 53*(1), 164-172.

Sauer, J. J. 2008. *The North American Breeding Bird Survey, Results and Analysis 1966-2007. Version 5.15.2008.* Retrieved from USGS Patuxent Wildlife Research Center, Laurel, Maryland: http://www.mbrpwrc.usgs.gov/bbs/bbs.html

Scheimen, D. E. 2003. Effects of Leafy Spurge Infestation on Grassland Birds. *Journal of Wildlife Management, 67*(1), 115-121.

Schmitz, D. and J. Jacobs. 2007. *Multi-Scale Impacts of Invasive Plants on Watershed Hydrology and Riparian Ecology -A Synthesis.* Prepared for Center for Invasive Plant Management, February 16, 2007.

Schuldt, D. (Wildlife Biologist). 2013 Personal observation regarding large populations of Lemhi Penstemon (*Penstemon lemhiensis*) and episodic flowering and seedset events. September 10, 2013.

Schulz, B. 2011. *The Noxious Weed Seedbank: Out of Sight-Out of Mind and Eventually out of Control .* Unviersity of Nevada Cooperative Extension, Fact Sheet 12-01.

Seastedt, T. D. 2007. Interactions and Effect of Multiple Biological Control Insects on Diffuse and Spotted Knapweed in the Front Range of Colorado. *42*(3), 345-354.

Sheley, R. 1994. *Identification, Distribution, Impacts, Biology and Management of Noxious Rangeland Weeds.* Walla Walla, Washington: USDA-Eastside Ecosystem Management Project, Interior Columbia Basin Ecosystem Management Project, Science Integration Team, Terrestrial Staff Range Task Group.

Sheley, R. and L. Half. 2006. Enhancing Native Forb Establishment and Persistence Using a Rich Seed Mixture. *Resotration Ecology, 14*(4), 627-635.

Sheley, R. and T. Whitson, V. Carrithers, J. Jacobs, and J. Gehrett. 2009. Grass Response to Picloram and Clopyralid Applied Before Seeding. *Weed Technology, 16*(3), 645-650.

Sheley, R., C. Duncan, M. Halstvedt and J. Jacobs. 2000. Spotted knapweed and grass response to herbicide treatments. *Journal of Range Managment, 53*(2), 176-182.

Simberloff, D. and P. Stiling. 1996. Risks of Species Introduced for Biological Control. *Biological Conservation, 78*(1996), 185-192.

Simpson, J.C. and R.L. Wallace. 1978. *Fishes of Idaho.* Moscow, Idaho: The University Press of Idaho, A Division of the Idaho Research Foundation, Inc.

Sing, S. R. Peterson, D. Weaver, R. Hansen and G. Markin. 2005. A Retrospective Analysis of Known and Potential Risks Associated with Exotic Toadflax-feeding Insections. *Biological Control, 35*(3), 276-287.

State of Idaho. 2008. Idaho Statute 22-19 the Idaho Invasive Species Act of 2008.

State of Idaho. Idaho Statute 22-34 Pesticides and Chemigation.

State of Idaho. Idaho Statute 22-2402 Noxious Weeds.

Stephens, A. and J. Myers. 2014. Testing biological control agent compatibility: Cyphocleonus achates and Larinus minutus on Diffuse Knapweed. *Biological Control, 70*(2014), 48-53.

Strayer, D. 2010. Alien species in fresh waters: ecological effects, interactions with other stressors, and prospectst for the future. *Freshwater Biology, 55*(Sup. 1), 152-174.

Stucki, D. and T. Rodhouse. 2009. *Distribution and Abundance of Lemhi Penstemon at Big Hole Nationa Battlefield. 2009 Inventory Report.* National Park Service.

Stucki, D., T. Rodhouse, J. Lyon and L Garrett. 2013. *Natural resource Conservation in a Cultural park: Evaluating the Importnace of Big Hole National Battlefield to the Endemic Lemhi Penstemon.* National Park Service.

Sullivan, T. 1990. Influence of forest herbicide on deer mouse and Oregon vole population dynamics. *Journal of Wildlife Management, 54*(4), 566-576.

Sullivan, T.P. and D.S. Sullivan. 2003. Vegetation management and ecosystem disturbance: impact of glyphosate herbicide on plant and animal diversity in terrestrial systems. *Environmental Review, 1*, 37-59.

Syracue Environmental Research Associates, Inc. (SERA). 2004b. *Clopyralid human health and ecological risk assessment final report. SERA TR-04-43-17-03c. December 5, 2004.*

Syracuse Environmental Research Associates, Inc. (SERA). 2004a. *Chlorsulfuron human health and ecological risk assessment final report. SERA TR-04-43-18-01c. November 21, 2004.*

Syracuse Environmental Research Associates, Inc. (SERA). 2004c. *Dicamba human health and ecological risk assessment final report. SERA TR-04-43-17-06d. November 24, 2004.*

Syracuse Environmental Research Associates, Inc. (SERA). 2004d. *Imazapic human health and ecological risk assessment final report. SERA TR-04-43-17-04b. December 23, 2004.*

Syracuse Environmental Research Associates, Inc. (SERA). 2004e. *Metasulfuron methyl human health and ecological risk assessment final report. SERA TR-04-43-17-01c. December 9, 2004.*

Syracuse Environmental Research Associates, Inc. (SERA). 2004f. *Sulfometuron methyl human health and ecological risk assessment final report. SERA TR-03-43-17-02c. December 14, 2004.*

Syracuse Environmental Research Associates, Inc. (SERA). 2007a. *Aminopyralid human health and ecological risk assessment final report. SERA TR-052-04-04a. June 28, 2007.*

Syracuse Environmental Research Associates, Inc (SERA), 2007b. *Gleams-Driver User Guide (Version 1.8). Prepared for USDA Forest Service. SERA TR 07-52-05-08a.*

Syracuse Envrionmental Research Associates, Inc. (SERA). 2007c. *Preparation of Environmental Documentation and Risk Assessments for the USDA/Forest Service.* Prepared by: Durkin, P.R. SERA MD 2007-01a. January 21, 2007.

Syracuse Environmental Research Associates, Inc. (SERA). 2010. *Imazamox human health and ecological risk assessment final report. SERA TR-052-24-02a. December 10, 2010.*

Syracuse Environmental Research Associates, Inc. (SERA). 2011a. *Glyphosate human health and ecological risk assessment final report. SERA TR-052-22-03b. March 25, 2011.*

Syracuse Environmental Research Associates, Inc. (SERA). 2011b. *Imazapyr human health and ecological risk assessment final report. SERA TR-052-27-03a. December 16, 2011.*

Syracuse Environmental Research Associates, Inc. (SERA). 2011c. *Picloram human health and ecological risk assessmenta final report. SERA TR-052-27-03a. September 29, 2011.*

Syracuse Environmental Research Associates, Inc. (SERA). 2011d. *Triclopyr human health and ecological risk assessment final report. SERA TR-052-25-03a. May 24, 2011.*

Tallamy, D.W. and K.J. Shropshire. 2008. Ranking Lepidopteran use of native versus introduced plants. *Conservation Biology, 23*(4), 941-947.

Taylor, K., J. Mangold, and L. Rew. 2011. *Weed Seed Dispersal by Vehicles.* Bozeman, Montana: MSU Extension MT201105AG.

Taylor, K., T Brummer, M. Taper, A. Wing, and L. Rew. 2012. Human-mediated Long-distance Dispersal-An Empirical Evaluation of Speed Dispersal by Vehicles. *Diversity and Distributions, 18*(9), 942-951.

TechLine. 1998. *Information about Invasive/Noxious Platn Managment: Mormon Ridge Elk Winter Range Restoration Project, Lolo National Forest, Montana.* Charles Henry: TechLine Editor.

Thomas, M. and A. Willis. 1998. BioControl: risky but Necessary. *Trends in Ecology and Evolution, 13*(8), 325-329.

Thompson, M.J. 1996. Winter foraging response of elk to spotted knapweed removal. *Northwest Science, 70*(1), 10-19.

Thorpe, A.S., G.C. Thelen, A. Diaconu and R.M. Callaway. 2009. Root excudate is allelopathic in invaded community but not in native community: field evidence for the novel weapons hypothesis. *Journal of Ecology, 97*, 641-645.

Tilman, D. 1987. Secondary succession and the pattern of plant dominance along experimental Nitrogen gradients. *Ecological Monographs, 57*(3), 189-214.

Trammell, M.A. and J.L. Butler. 1995. Effects of Exotic Plants on Native Ungulate Use of Habitat. *Journal of Wildlife Management, 59*(4), 808-816.

Travaset, A. and D. Richardson. 2006. Biological Invasions as Disruptors of Plant Reproductive Mutualisms. *Trends in Ecology and Evolution, 21*(4), 208-216.

TREC, Inc. 2004. *Summary report: A survey for Yellow-billed Cuckoo in recorded historic and other likely locations in Idaho.* Rigby, Idaho: Unpublished Report.

Trevathan, W. 2002a. *Clopyralid Pesticide Fact Sheet .* Oregon State Unversity Extension Service .

Trevathan, W. 2002b. *Glyphosate Pesticide Fact Sheet.* Oregon State Unversity Extension Service .

Trevathan, W. 2002c. *Imazapyr Pesticide Fact Sheet .* Oregon State Unviersity Extension Service .

Trevathan, W. 2002d. *Metsulfuron Methyl Pesticide Fact Sheet .* Oregon State University Extension Service .

Trevathan, W. 2002e. *Picloram Pesticide Fact Sheet .* Oregon State University Extension Service .

Trevathan, W. 2002f. *Sulfometuron Methyl Pesticide Fact Sheet .* Oregon State Extension Service .

Trevathan, W. 2002g. *Triclopyr Pesticide Fact Sheet .* Oregon State University Extension Service .

Trevors, J. 1998. Bacterial Biodiversity in Soil with an Emphasis on Chemically-Contaminated Soils. *Water, Air and Soil Pollution, 101*, 45-67.

Tu, M., C. Hurd, and J.M. Randall. 2001. *Weed control methods handbook tools and techniques for use in natural areas.* Retrieved from The Nature Conservancy: http://www.invasive.org/gist/handbook.html

Tyser, R. 1992. Vegetation Associated with Two Alien Plant Species in a Fescue Grassland in Glacier National. *Great Basin Naturalist, 52*(2), 189-193.

U.S. Environmental Protection Agency. 1992. *Chlorsulfuron data evaluation record.* Arlington, VA: Office of Pesticides and Toxic Substances, U.S. Environmental protection Agency.

U.S. Environmental Protection Agency. 1997. *Imazamox pesticide fact sheed.* Arlington, VA: Office of Pesticide Programs, U.S. Environmental Protection Agency.

U.S. Environmental Protection Agency and US Department of the Army, 2008. Clean Water Act Jurisdiction Following the US Supreme Court's Decision in Rapanos v United States & Carabell v United States. Memorandum, signed December 2, 2008.

U.S. Environmental Protection Agency, 2009. National Primary Drinking Water Regulations. EPA 816-F-09-004. May, 2009.

U.S. Environmental Protection Agency. 2012a. *Label Review Manual Chapter 7: Precautionary Statements.* Retrieved from http://www.epa.gov/oppfead1/labeling/lrm/chap-07.pdf

U.S. Environmental Protection Agency. 2012b. *Inert (other) pesticide ingredients in pesticide products-categorized list of inert (other) perticide ingredients.* Retrieved from http://www.epa.gov/opprd001/inerts/oldlists.html

U.S. Environmental Protection Agency. 2013. *Inert ingredient frequently asked questions.* Retrieved from http://www.epa.gov/opprd001/inerts/faqs.pdf

University of Idaho Extension. 2011. *Agriculture: A foundation for Idaho's ecolonomy.*

Urban, D.J. and J.N. Cook. 1986. *Ecological Risk Assessment. Hazard Evaluation Division Standard Procedure.* Washington, D.C.: Office of Pesticide Programs, US EPA, EPA-54019-83-001.

Urgenson, L. 2006. *The Ecological Consequences of Knotweed Invasion into Riparian Forests. A thesis submitted in partial fulfillment of the requirements for the degree of Masters of Science (Forest Resources).* University of Washington .

U.S. Geological Survey. 2013a. Streamstats. Accessed 5/8/2013 at http://water.usgs.gov/osw/streamstats/index.html.

U.S. Geological Survey. 2013b. *NASA Earth Exchange Downscaled Clinate Projections (NEX-DCP30) data set.* Climate and Land Use Change Research and Development Program. Retrieved from http://www.usgs.gov/climate_landuse/clu_rd/apps/nex-dcp30_viewer.asp

U.S. Geological Survey, 2014. National Water Information System. Accessed March 2014 at http://waterdata.usgs.gov/nwis.

USDA Forest Service . 1988. *Idaho and Wyoming Endangered and Sensitive Plant Field Guide .* U.S. Department of Agriculture, Forest Service, Intermountain Region.

USDA Forest Service. 1998a. *Strategy for Noxious and Nonnative Invasive Plant Managemen.* U.S. Department of Agriculture, Forest Service.

USDA Forest Service . 1998b. *Stemming the Invasive Tide: FS Strategy fo Management of Noxious and Nonnative Plant Management .* U.S. Department of Agriculture.

USDA Forest Service. 1988c. Forest Service Handbook 2509.22, Soil and Water Conservation Practices Handbook. R-1/R-4 Amendment No.1, Effectove 05/88.

USDA Forest Service. 1990. Forest Service Manual 2500, Watershed and Air Management, Chapter 2530 – Water Resource Management. WO Amendment 2500-90-1, Effective 6/1/1990.

USDA Forest Service. 1995. Inland Native Fish Strategy Environmental Assessment, Decision Notice, and Finding of No Significant Impact. USDA Forest Service, Intermountain, Northern, and Pacific Northwest Regions.

USDA Forest Service . 1999. *Frank Church River of No Return Noxious Weed Treatments Final Environmental Impact Statement .* Intermoutain and Northern Regions: Bitterroot, Nez Perce, Payette and Salmon-Challis National Forest .

USDA Forest Service.2004. *Forest Service national Strategy and Implementation Plan for Invasive Species Management. FS-805.* U.S. Department of Agruiculture, Forest Service.

USDA Forest Service . 2005a. *Forest Service Handbook 5709-16 Flight Operations Handbook Chapter 20. .* Washington, D.C.: Forest Service National Headquarters.

USDA Forest Service . 2005b. *Forest Service Manual 2760-Threatened, Endangered and Sensitive Plants and Animals. Effective 2005.* U.S. Department of Agriculture, Forest Service .

USDA Forest Service. 2005c. *FSM Wildlife, fish and sensitive plant habitat management. Chapter 2670-Threatened, endangered and sensitive plants and animals. 2600-2005-1.*

USDA Forest Service. 2006. *2,4-D human health and ecological risk assessment final report, September 30, 2006.* Arlington, VA: USDA Forest Service.

USDA Forest Service. 2007. *Northern Rockies lynx management direction record of decision.* U.S. Department of Agriculture, Forest Service, National Forests in Montana, and parts of Idaho, Wyoming, and Utah.

USDA Forest Service . 2008. *Forest Service Manual 2070 Vegetation Ecology .* Washington, D.C. : U.S. Department of Agriculture, Forest Service National Headquarters .

USDA Forest Service. 2008. Title 36 CFR Part 294: Special Areas; Roadless Area Conservation; Applicability to the National Forests in Idaho; Final Rule. *Federal Register, Vol 73., No. 201*. October 16, 2008. 61456-61496 pp.

USDA Forest Service . 2009. *Forest Service Manual 5700 Aviation Management.* Washington, D.C.: U.S. Department of Agriculture, Forest Service National Headquarters.

USDA Forest Service. 2011a. *Forest Service Manual 2900-Invasive Species Management. Effective 2011.* U.S. Department of Agriculture, Forest Service .

USDA Forest Service . 2011b. *Watershed Condition Classification Technical Guide. FS-978, July 2011.* U.S. Department of Agriculture, Forest Service .

USDA Forest Service. 2011c. *National Roadmap for Responding to Climate Change. FS-957b.* U.S. Department of Agriculture, Forest Service. February 2011.

USDA Forest Service . 2012a. 36 CFR Subpart A, Section 222.8.

USDA Forest Service. 2012b. *National Best Management Practices for Water Quality Management on National Forest System Lands, Volume 1: National Core BMP Technical Guide, FS-990a, April 2012.* U.S. Department of Agriculture, Forest Service.

USDA Forest Service. 2012c. *FSH 1909.15 National Environmental Polict Act Handbook 1909.15-2012-3.* U.S. Department of Agriculture, Forest Service.

USDA Forest Service. 2012d. Interim Conservation Recommendations for Greater Sage-Grouse and Greater Sage-Grouse Habitat. U.S. Department of Agriculture, Forest Service, Region 1,2,, and 4. Guidance document 11pp.

USDA Forest Service . 2013. *National Aviation Safety and Management Plan, Region 1 Supplement.* Missoula, Montana: U.S. Department of Agriculture, Forest Service, Region 1.

USDA Forest Service . 2014. FSM 5140 Hazardous Fuels Managment and Prescribed Fire. 5100-2014-3.

USDA Forest Service. 2013. *Forest Service National Strategy Framework for Invasive Species Management, FS-1017. August 2013.* U.S. Department of Agriculture, Forest Service.

USDA Forest Service. 2013. *Forest Service National Strategy Framework for Invasive Species Management, FS-1017. August 2013.* U.S. Department of Agriculture, Forest Service.

USDA Forest Service. 2014. *National Forest System Invasive Species Managaement Record Keeping and Business Rules and National Standards.* Washington, D.C.: U.S. Department of Agriculture, Forest Service .

USDA Forest Service and USDI Bureau of Land Management . 1995. *Decision Notice/Decision Record Finding of No Significant Impact, and Environmental Assessment for the Interim Strategies for Managing Anadromous Fish-producing Watersheds in Easter Oregon and Washington, Idaho, and Portions of California.*

USDA Forest Service, Beaverhead-Deerlodge National Forest . 2001. *Beverhead-Deerlodge National Forest Noxious Weed EIS .* U.S. Department of Agriculture, Beaverhead-Deerlodge National Forest.

USDA Forest Service, Challis National Forest. 1987. *Challis National Forest land and Resource Management Plan.* Challis, Idaho: U.S. Deparment of Agriculture, Forest Service, Challis National Forest.

USDA Forest Service, Custer National Forest. 2006. *Draft Environmental Impact Statement weed management Custer National Forest. Appendix J*. U.S. Deparmtent of Agriculture, Forest Service, Custer National Forest, Region 1, Billings MT. 8 pp

USDA Forest Service, Flathead National Forest. 2000. *Flathead National Forest Noxious and Invasive Weed Control Environmental Assessment .*

USDA Forest Service, Intermoutain Region (R4). 2001. *FSM 2080 Region 4 Supplement R4 200-2001-1, 2081.2 Prevention and Control Measures.*

USDA Forest Service, Intermountain Region (R4) . 2014. *Intermountain Aviation Safety and Management Plan.* Ogden, Utah : U.S. Department of Agriculture, Forest Service, Intermountain Region.

USDA Forest Service, Intermountain Region (R4). 2014. *Invasive Species Management Strategy, FY 2009-2013.* Ogden, Utah: U.S. Department of Agriculture, Forest Service, Intermountain Region.

USDA Forest Servic, Lolo National Forest . 2001. *Lolo National Forest Big Game Winter Range and Burned Weed Management Final Environmental Impact Statement .* U.S. Department of Agriculture, Forest Service.

USDA Forest Service, Lolo National Forest . 2007. *Final Environmental Impact Statement, Integrated Weed management on the Lolo National Forest .* U.S. Department of Agriculture, Forest Service, Lolo National Forest, December 2007.

USDA Forest Service, Panhandle National Forest . 2001. *Sandpoint Ranger District Noxious Weeds Control Final Environmental Impact Statement .* U.S. Department of Agricutlure, Forest Service.

USDA Forest Service, Salmon National Forest. 1988. *Salmon National Forest Land and Resource Management Plan.* Salmon, Idaho: U.S. Department of Agriculture, Forest Service, Salmon National Forest.

USDA Forest Service, Salmon-Challis National Forest. 2004. *Environmental Assessment for Proposed Amendment to the Managment Indicator Species List for the Salmon and Challis Land and Resource Management Plans.* Salmon, Idaho: Salmon-Challis National Forest.

USDA Forest Service, Salmon-Challis National Forest . 1998. *North Fork Headwaters Watershed Analysis.* North Fork Ranger District, Salmon-Challis National Forest .

USDA Forest Service, Salmon-Challis National Forest . 2007. *Frank Church-River of No Return Wilderness Noxious Weed Treatments Final Supplemental Environmental Impact Statement, November 2007 .* U.S. Department of Agriculture, Forest Service, Salmon-Challis National Forest .

USDA Forest Service, Salmon Challis National Forest. 2012 Natural Resource Informaiton System, Threatened, Endangered and Sensitive Plants-Invasive Species Integrated Database Application

USDA Forest Service, Salmon-Challis National Forest . 2014. *Forest Aviation Plan 2014 Supplement to Northern and Intermountain Region Aviation Management Plan .* Salmon, Idaho: U.S. Department of Agriculture, Forest Service, Salmon-Challis National Forest .

USDA Forest Service, Salmon-Challis National Forest . 2012. *Natural Resource Information System, Threatened, Endangered and Sensitive Plants-Invasive Species Integrated Database Application.*

USDA Forest Service, Wallowa-Whitman National Forest . 2010. *Wallowa-Whitman National forest Invasive Plants Treatment Project Final Environmental Impact Statement, Chapter 3-Affected Environment and Environmental Consequences, March 2010 .* U.S. Department of Agriculture, Forest Service, Wallowa-Whitman National Forest.

USDA NRCS Plants Database. 2015a. Colorado State-listed Noxious Weeds. Available online at: http://plants.usda.gov/java/noxious?rptType=State&statefips=08, accessed on January 6, 2015.

USDA NRCS Plants Database. 2015b. Montana State-listed Noxious Weeds. Available online at: http://plants.usda.gov/java/noxious?rptType=State&statefips=30, accessed on January 6, 2015.

USDA NRCS Plants Database. 2015c. Oregon State-listed Noxious Weeds. Available online at: http://plants.usda.gov/java/noxious?rptType=State&statefips=41, accessed on January 6, 2015.

USDA NRCS Plants Database. 2015d. Utah State-listed Noxious Weeds. Available online at: http://plants.usda.gov/java/noxious?rptType=State&statefips=49, accessed on January 6, 2015.

USDA NRCS Plants Database. 2015e. Washington State-listed Noxious Weeds. Available online at: http://plants.usda.gov/java/noxious?rptType=State&statefips=53, accessed on January 6, 2015.

USDA NRCS Plants Database. 2015f . Wyoming State-listed Noxious Weeds. Available online at: http://plants.usda.gov/java/noxious?rptType=State&statefips=56, accessed on January 6, 2015.

USDA Soil and Water Conservation Act. 2012. *Rangeland Conservation Analysis #3-controllingleafy spurge on rangelands in the northern plains.* Unpulbished reveiw draft.

USDC National Marine Fisheries Service. 2012. *Reinitiation of the Endangered Species Act Section 7 Formal Consultation and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for the Salmon-Challis National Forest Noxious Weeds management Program.*

(non-wilderness), Upper Salmon River Basin-170602, Lemhi and Custer Counties, Idaho. NMFS No: 2012002030.

USDI Bureau of Land Management and USDI Forest Service. 2015. Idaho and Southwestern Montana Greater Sage-grouse Proposed Land Use Plan Amendment and FEIS. ID and SW MT BLM Management Actions and FS Plan Components- a crosswalk. 66 pp.

USDI Fish and Wildlife Service. 1984. *American peregrin falcon recovery plan (Rocky Mountain/Southwest population).* Denver, Colorado: Prepared in cooperation with the American peregrin falcon recovery team.

USDI Fish and Wildlife Service. 1994. *The reintroduction of gray wolves in Yellowstone Nationa Park and central Idaho. Final environmental impact statement.* Helena, Montana: U.S. Department of Interior, Fish and Wildlife Service.

USDI Fish and Wildlife Service . 2000. *Endangered and Threatened Wildlife and Plants, Determination of Threatened Status for the Contiguous U.S. Distinct Population Sement of the Canada Lynx and Related Rule. Federal REgister 65 (24 March 2000): 16052-16086.*

USDI Fish and Wildlife Service . 2000. *Endangered and Threatened Wildlife and Plants, Determination of Threatened Status for the Contiguous U.S. District Population Segment of the Canada Lynx and Related Rule. Federal Register 65 (24 March 2000): 16052-16086.*

USDI Fish and Wildlife Service . 2001. *Endangered and Threatened Wildlife and Plants; Reissuance of Final Rule To Identify the Northern Rocky Mountain Population of Gray Wolf as Distinct Population Segment and To Revise the List of Endangered and Threatened Wildlife.* Federal Register 76 (25 July 2001): 25590-25592.

USDI Fish and Wildlife Service. 2004. *A blueprint for the future of migratory birds. Migratory Bird Program Stategic Plan 2004-2014 [Accessed 4 May 2006].* Retrieved from http://www.fws.gov/migratorybirds/mbstratplan/MBStratPlanTOC.htm

USDI Fish and Wildlife Service. 2006. *A Bluepring for future of migratory birds.* Migratory Bird Program Strategic Plan 2004-2014. Retrieved May 4, 2006, from http://www.fws.gov/migratorybirds/mbstratplan/MBStratPlanTOC.htm

USDI Fish and Wildlife Service . 2007. *Endangered and Threatened Wildlife and Plants, Removing the Bald Eagle in the Lower 48 States from the List of Endangered and Threatened Wildlife. Federal Register 72 (9 July 2007): 37345-37372.*

USDI Fish and Wildlife Service . 2010a. *Endangered and Threatened Wildlife and Plants; 12-Month Findings for Petitions to List the Greater Sage-Grouse (Cetrocercus urophasianus) as Threatened or Endangered. Federal Register 75 (23 March 2010): 13910-14014 .*

USDI Fish and Wildlife Service . 2010b. *Endangered and Threatened Wildlife and Plants, 12-month Finding on a Petition to List the Mountain Whitefish in the Big Lost Rive, Idaho, as Endangered or Threatened. Federal Register, 75 FR 17352-17363. April 6, 2010.*

USDI Fish and Wildlife Service.2012. *Confirmation of conference opinion and extension of programmatic consulatation for noxious weed management non-wilderness lands manged by the Salmon-Challis National Forest in Idaho. Reference number 14420-2012-TA-0412.*

USDI Fish and Wildlife Service. 2013a. *Endangered Species Act Basics-Forty Years of Conserving Endangered Species, January 2013.* U.S. Department of the Interior, U.S. Fish and Wildlife Service.

USDI Fish and Wildlife Service . 2013b. *Endangered and Threated Wildlife and Plants; Proposed Threatened Status for the Western Distinct Population Segment of the Yellow-billed Cuckoo (Coccyzus americanus); Proposed Rule. Federal Register 78 (3 October 2013): 61622-61666.*

USDI Fish and Wildlife Service . 2014a. *Endangered and Threatened Wildlife and Plants; 6-Month Extension of Fianl Determination for the Proposed Listing of the Distinct Population Segment of the North American Wolverine Occurring in the Contiguous United States as Threatened Species.* Federal Register 79 (5 February 2014): 6874-6875.

USDI Fish and Wildlife Service . 2014b. *Endangered and Threatened Wildlife and Plants; Proposed Threatened Status for the Wester Distinct Population Segment of the Yellow-Billed Cuckoo (Coccyzus americanus). Federal Register 79 (10 April 2014): 19860-19861.*

USDI Fish and Wildlife Service. 2014c. National Wetlands Inventory. Accessed May 2014 at http://www.fws.gov/wetlands.

USDI Fish and Wildlife Service. 2014d. *SCNF Invasive Plant Treatment EIS: List of threatened and endangered species that occur in your proposed project location, and/or may be affected by your proposed project. Consulation Tracking Number: 01EIF WOO-2014-SLI-0432 (29 April 2014).*

USDI Fish and Wildlife Service and USDC Census Bureau. 2011. *National Survey of Fishing, Hunting and Wildlife Associate Recreation.* Idaho.

USDOE-Bonneville Power Administration. 2000. *Chlorsulfuron herbicide fact sheet.*

USDOE-Bonneville Power Administration. 2000. *Sulfometuron methyl herbicide fact sheet.*

USFWS, National Marine Fisheries Service, Plum Creek Timber Company, and CH2M Hill. 2000. *Final Environmental Impact Statement and Native Fish Habitat Conservation Plan, Propose Permit for Taking of Federally Listed Native Fish Species on Plum Creek Timber Compancy, Inc., Lands* . Boise, Idaho.

Van Driesche, R., R. Carruthers, T. Center, M Hoddle, J. Hought Goldstein. L. Morin, L. Smith, D. Wagner, B. Blossey, V. Brancatinin, R. Casagrande, C. Causton, J. Coetzee, J. Cudam, J. Ding, S. Fowler, J. Frank, R. Ruester, J. Goolsby, and others. 2010. Classical Biological Control for the Protection of Natural Ecosystems. *Biolgoical Control, 54*(2010), S2-S33.

Vogue, P.A., E.A. Kerle and J.J. Jenkins. 1994. *OSU Extension Pesticide Properties Database. Properties Database. National Pesticide Information Center*. Retrieved May 23, 2012, from http://npic.orst.edu/ingred/ppdmove.htm

Wagner, G.D. and J.M. Peek. 2006. Bighorn diet selection and forage quality in central Idaho. *Northwest Science, 80*(4), 246-258.

Wallace, J., T.S. Prather, and V. Peterson. 2012. Effects of Aminopyralid on Ponderosa Pine. *Invasive Plant Science and Management, 5*(2), 164-169.

Warren, N. 1980. *Bald eagle wintering habitat on selected portions of the Boise, Challis, and Sawtooth national Forests.* Boise, Idaho: U.S. Department of Agriculture, Boise National Forest.

Washington State Noxious Weed Control Board. Undated. Bees and Noxious Weed Control: finding common ground. Brochure, 2 pp. Available online at: *www.nwcb.wa.gov/publications/**bee**_brochure_web.pdf*, accessed on January 6, 2015.

Waterbury, B. 2008. *Spreadsheet showing results of 2007 owl surveys.* Idaho Department of Fish and Game.

Waterbury, B. 2009. *Salmon Region Bald Eagle Nesting Report.* Idaho Department of Fish and Game.

Waterbury, B. 2012. *Flammulated Owl (Otus flammeolus) Sureys Salmon-Challis National Forest.* Challenge Cost Share Agreement No. 07-CS-11041304-047 U.S. Deparment of Agriculture, U.S. Forest Service, Salmon-Challis National Forest and Idaho Deparment of Fish and Game.

Waterbury, B. 2012. *North Zone Salmon-Challis National Forest Wolverine (Gulo gulo) Project.* Challenge Cost Share Agreement No. 07-CS-11041304-047. U.S. Department of Agriculture, U.S. Forest Service Salmon-Challis National Forest and Idaho Deparmtnet of Fish and Game.

Waterbury, B. 2013. *Mid-winter bald eagle survey results.* Email/spreadsheets.

Watson, P., G. Taylor, and S. Cooke. 2006. *The Contributions of Agriculture to Idaho's Economy.* University of Idaho Extension, CIS 1144.

Watson, V.J., and P.M. Rice and E.C. Monnig. 1989. Environmental fate picloram used for roadside weed control. *18*(2).

Webster, G.L. 1986. Irritant plants in the spurge family (Euphorbiaceae). *Clinics in Dermatology, 4*(2), 36-45.

Weidenhamer, J.D. and R.M. Callaway. 2010. Direct and Indirect Effects of Invasive Plants on Soil Chemistry and Ecosystem Function. *Journal of Chemical Ecology, 36*(1), 59-69.

Westbrooks, R.G. 1998. *Invasive plants: changing the landscape of America fact book.* Washington, D.C.: Federal Interagency Committee for the Managment of Noxious and Exotic Weeds.

Western Regional Climate Center. 2014. *Idaho Climate Summaries*. Retrieved March 2014, from http://www.wrcc.dri.edu/summary/climsmid.html

Whitney, K.D. and C.A. Gabler. 2008. Rapid evoluation in introduced species, 'invaisve traits' and recipient communities: challengers for predicting invasive potential. *Diversity and Distributions, 2008*(14), 569-580.

Wilson, B. and V. Hipkins, E. Rey-Vizgirdas and T. Kaye. 2005. Variation in Lewisia kelloggii with Description of a New Species Endemic to Idaho. *Western North American Naturalist, 65*(3), 345-358.

Wolf, R. 2000. Strategies to Reduce Spray Drift. Kansas State University Agricultural Experiment Station and Cooperative Extension Service. MF-2444, Application Technology Series.

Yahnke, A., C. Grue, and M. Hayes and A. Troiano.2013. Effects of the herbicide imazapyr on juvenile Oregon spotted frogs. *Environmental Toxicology and Chemistry, 32*(1), 228-235.

Young, J.A. and W.S. Longland. 1996. Impact of Alien Plants on Grant Basin Rangelands. *Weed Technology, 10*(2), 384-391.

Yurkonis, K. S. Meiners and B. Wachholder. 2005. Invasion Impacts Diversity through Altered Community Dynamics. *Journal of Ecology, 93*(6), 1053-1061.

Zollinger, R. 2012. 2012 North Dakota weed control guide. NDSU Agricultural Experiment Station. Available online: http://www.ag.ndsu.edu/weeds/weed-control-guides/nd-weed-control-guide-1

Zouhar, K., G. Munger and J. Kapler-Smith. 2008. Gaps in Scientific Knowledge About Fire and Non-Native Invasvie Plants. In K. J.-S. Zouhar, *Wildland fire in ecosystems: fire and nonnative invasive plants* (pp. 243-259). Ogden, Utah: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. RMRS-GTR-42, Volume 6.

Appendix A: Idaho Terrestrial and Aquatic Noxious Weeds-Early Detection/Rapid Response, Control, Containment, and Watch Lists

Table A-1: Idaho Statewide Early Detection/Rapid Response List[1]

Common Name	Scientific Name	Common Name	Scientific Name
Brazilian Elodea	*Egeria densa*	Squarrose Knapweed	*Centaurea triumfetti*
Common/ European Frogbit	*Hydrcharis morsus-ranae*	Sticky Nightshade	*Solanum sisymbriifolium*
Fanwort	*Cobomba caroliniana*	Syrian Beancaper	*Zygophyllum fabago*
Feathered Mosquito Fern	*Azolla pinnata*	Tall Hawkweed	*Hieracium piloselloides*
Giant Hogweed	*Heracleum mantegazzianum*	Variable-Leaf-Milfoil	*Myriophyllum heterophyllum*
Giant Salvinia	*Salvinia molesta*	Water Chestnut	*Trapa natans*
Hydrilla	*Hydrilla verticillata*	Water Hyacinth	*Eichhornia crassipes*
Iberian Starthistle	*Centaurea iberica*	Yellow Devil Hawkweed	*Hieracium glomeratum*
Policeman's Helmet	*Impatiens glandulifera*	Yellow Floating Heart	*Nymphoides peltata*
Purple Starthistle	*Centaurea calcitrapa*	Sulfur Cinquefoil (Lemhi County)	*Potentilla recta*

Table A-2: Idaho Statewide Control List[1]

Common Name	Scientific Name	Common Name	Scientific Name
Black Henbane	*Hyoscyamus niger*	Meadow Knapweed	*Centaurea debeauxii*
Bohemian Knotweed	*Polygonum bohemicum*	Mediterranean Sage	*Salvia aethiopis*
Buffalobur	*Solanum rostratum*	Musk Thistle	*Carduus nutans*
Common Crupina	*Crupina vulgaris*	Orange Hawkweed	*Hieracium aurantiacum*
Common Reed (Phragmites)	*Phragmites australis*	Parrotfeather Milfoil	*Myriophyllum aquaticum*
Dyer's Woad	*Isatis Tinctoria*	Perennial Sowthistle	*Sonchus arvensis*
Eurasian Watermilfoil	*Myriophyllum spicatum*	Russian Knapweed	*Acroptilon repens*
Giant Knotweed	*Polygonum sachalinense*	Scotch Broom	*Cytisus scoparius*
Japanese Knotweed	*Polygonum cuspidatum*	Small Bugloss	*Anchusa arvensis*
Johnsongrass	*Sorghum halepense*	Vipers Bugloss	*Echium vulgare*
Matgrass	*Nardus stricta*	Yellow Hawkweed	*Hieracium caespitosum*

Table A-3: Idaho Statewide Containment List[1]

Common Name	Scientific Name	Common Name	Scientific Name
Canada Thistle	*Cirsium arvense*	Poison Hemlock	*Conium maculatum*
Curlyleaf Pondweed	*Potamogeton crispus*	Puncturevine	*Tribulus terrestris*
Dalmatian Toadflax	*Linaria dalmatica ssp. dalmatica*	Purple Loosestrife	*Lythrum salicaria*
Diffuse Knapweed	*Centaurea diffusa*	Rush Skeletonweed	*Chondrilla juncea*
Field Bindweed	*Convolvulus arvensis*	Saltcedar	*Tamarix sp.*
Flowering Rush	*Butomus umbelltus*	Scotch Thistle	*Onopordum acanthium*
Hoary Alyssum	*Berteroa incana*	Spotted Knapweed	*Centaurea stoebe*
Houndstongue	*Cynoglossum officinale*	Tansy Ragwort	*Senecio jacobaea*
Jointed Goatgrass	*Aegilpos cylindrica*	White Bryony	*Bryonia alba*
Leafy Spurge	*Euphorbia esula*	Whitetop	*Cardaria draba*
Milium	*Milium vernale*	Yellow Flag Iris	*Iris pseudacorus*
Oxeye Daisy	*Leucanthemum vulgare*	Yellow Starthistle	*Centaurea solstitialis*
Perennial Pepperweed	*Lepidium latifolium*	Yellow Toadflax	*Linaria vulgaris*
Plumeless Thistle	*Carduus acanthoides*		

[1]Idaho State Department of Agriculture (2015)

Table A-4: Salmon-Challis National Forest Watch List

Common Name	*Scientific Name*	Occurs in Butte County	*Occurs in Custer County*	*Occurs in Lemhi County*	*Occurs in Adjacent Counties*	*States in which Listed as Noxious*[1]
Buffalobur	*Solanum rostratum*	Yes	No	No	Yes	ID, OR, WA
Common Burdock	*Arctium minus*	Yes	No	Yes	Yes	WY, CO
Common Crupina	*Crupina vulgaris*	No	No	No	Yes	ID, MT, CO, NV, OR, WA
Curlyleaf Pondweed	*Potamgeton crispus*	No	No	No	Yes	ID, WA
Dame's Rocket	*Hesperis matronalis*	No	No	Yes	Yes	CO
Diffuse Knapweed	*Centaurea diffusa*	Yes	Yes	Yes	Yes	ID, MT, WY, CO, UT, NV, OR, WA
Dyer's Woad	*Isatis tinctoria*	Yes	Yes	Yes	Yes	ID, MT, WY, UT, NV, OR
Eurasian Water Milfoil	*Myriophyllum spicatum*	No	No	No	Yes	ID, MT, CO, NV, OR, WA
Field bindweed	*Convolvulus arvensis*	Yes	Yes	Yes	Yes	ID, MT, WY, UT, OR, WA
Hieracium complex	*Hieracium spp.*	No	No	No	Yes	ID, MT, CO, OR, WA
Johnsongrass	*Sorghum halepense*	No	No	No	Yes	ID, UT, NV, OR, WA
Jointed Goatgrass	*Aegilops cylindrica*	No	No	No	Yes	ID, CO, OR, WA
Matgrass	*Nardus stricta*	No	Yes	No	Yes	ID, OR
Meadow Knapweed	*Centaurea debeauxii*	No	No	No	Yes	ID, CO, OR
Mediterranean Sage	*Salvia aethiopis*	No	No	No	Yes	ID, CO, NV, OR, WA
Millet	*Milium vernale*	No	No	No	Yes	ID
North African Grass	*Ventenata dubia*	No	No	No	Yes	N/A
Perennial Sowthistle	*Sonchus arvensis*	No	No	Yes	Yes	ID, WY, CO, NV
Plumeless Thistle	*Carduus acanthoides*	Yes	No	No	Yes	ID, WY, CO, OR, WA
Poison Hemlock	*Conium maculatum*	Yes	No	No	Yes	ID, NV, OR, WA

Common Name	*Scientific Name*	Occurs in Butte County	*Occurs in Custer County*	*Occurs in Lemhi County*	*Occurs in Adjacent Counties*	*States in which Listed as Noxious*[1]
Purple Loosestrife	*Lythrum salicaria*	No	Yes	Yes	Yes	ID, MT, WY, CO, UT, NV, OR, WA
Russian Knapweed	*Acroptilon repens*	Yes	Yes	Yes	Yes	ID, MT, WY, CO, UT, NV, OR, WA
Scotch Broom	*Cytisus scoparius*	No	No	No	Yes	ID, MT, OR, WA
Scotch Thistle	*Onopordium acanthum*	Yes	Yes	Yes	Yes	ID, WY, CO, UT, NV, OR, WA
Small Bugloss	*Anchusa arvensis*	No	No	No	Yes	ID, WA
Syrian Beancaper	*Zygophyllum fabago*	Yes	No	No	Yes	ID, NV, OR, WA
Tall Buttercup	*Ranunculus acris*	No	Yes	Yes	Yes	MT
Tansy Ragwort	*Senecio jacobaea*	No	Yes	No	Yes	ID, MT, CO, OR, WA
Vipers Bugloss	*Echium vulgare*	No	Yes	No	Yes	ID, MT, WA
White Bryony	*Bryonia alba*	Yes	Yes	No	Yes	ID, WA
Yellow Flag Iris	*Iris pseudacoris*	No	No	No	Yes	MT, OR, WA
Yellow Starthistle	*Centauria solstitialis*	No	No	No	Yes	ID, MT, CO, UT, NV, OR, WA

Table A-5: Aquatic Invasive Plants

Common Name	Family	Growth Form	Dispersal Mechanism	Preferred Habitat	Distribution
Bohemian knotweed	*Polygonacea*	Emergent	rhizomes, stem fragments	Wetlands, riparian	Bonner, Kootenai, Washington, Ada, Jefferson
Brazilian elodea	*Hydrocharitaceae*	Submersed	Floating fragments	All	Ada and Latah Counties
Common reed (Phragmites)	*Poaceae*	Emergent	wind/seed, rhizomes	wetlands	Bear Lake area, Lower Snake River, Coeur d'Alene river
Common/European frogbit	*Hydrocharitaceae*	Submersed	Boats/trailers	Still water	Population identified in western Washington
Curlyleaf pondweed	*Potamogetonaceae*	Submersed	boats/trailers	shallow/deep water	Wide distribution in Idaho
Eurasian watermilfoil	*Haloragaceae*	Submersed	Floating fragments, rhizomes	ponds, lakes, streams, canals, ditches	Wide distribution in Idaho
Fanwort	*Cabombaceae*	Submersed	Floating fragments	lakes and ponds, sometimes rivers, colonizes shoreline->interior	Populations in western Washington
Feathered mosquito fern	*Azollaceae*	Floating	spores: current or wind	still or flowing water	Not found in the Western US
Flowering rush	*Butomaceae*	Emergent	rhizomes, seeds in water	wetlands, flat water up to 20 feet deep	In the Aberdeen area and in the Lake Pend Oreille system
Giant knotweed	*Polygonacea*	Emergent	Floating fragments	Wetlands, riparian	Bonner, Kootenai, Shoshone
Giant salvinia	*Salviniaceae*	Floating	Floating fragments	still or flowing water	Not found in the Northwestern US.
Hydrilla	*Hydrocharitaceae*	Submersed	Floating fragments	canals, rivers, ponds, lakes, reservoirs	Owyhee, Ada
Japanese knotweed	*Polygonacea*	Emergent	Floating fragments	Wetlands, riparian	Panhandle, Idaho, Lemhi, Power, Ada, Gem
Parrotfeather milfoil	*Haloragaceae*	Submersed	Floating fragments	ponds, lakes, rivers, canals, ditches	Payette, Gem, Jerome
Purple loosestrife	*Lythraceae*	Emergent	seeds in water	wetlands, watercourse banks, pond edges	Most of Idaho, Inc. Custer/Lemhi Counties

Common Name	Family	Growth Form	Dispersal Mechanism	Preferred Habitat	Distribution
Variable-leaf milfoil	*Haloragaceae*	Submersed	seed, floating fragments	water up to 8 feet deep with organic matter on bottom	Populations in western Washington
Water chestnut	*Trapaceae*	Submersed	Floating fragments	shallow, flat/slow-moving water	Found in the Northeastern US
Water Hyacinth	*Pontederiaceae*	Floating	seed, floating fragments	All	Populations in Oregon and Washington
Yellow flag iris	*Iridaceae*	Emergent	rhizomes/seed, post-fire colonizer	wetlands, edges of ponds, slow moving streams up to 10in deep	Wide distribution in Idaho
Yellow floating heart	*Menyanthaceae*	Floating	stem frags/seed	ponds, lakes	Gem County Idaho

1USDA NRCS Plants Database (2015a, 2015b, 2015c. 2015d, 2015e, 2015f

Appendix B: Salmon-Challis National Forest Personnel Safety and Emergency Spill Response Plan for the Use of Herbicides in the Control of Invasive Plants

Herbicide use

A licensed applicator will supervise and instruct each applicator in the safe use of particular herbicides so as to protect themselves and the environment. Topics to be covered include first aid, hygiene, personal protective equipment, safe handling and proper application, transportation, storage, spill management, and disposal. Licensed applicators will maintain a daily application log for herbicides applications under his/her supervision.

Safety instructions will be documented with Job Hazard Analyses (JHAs) and tailgate safety sessions. Signed forms will be kept in the project file. A copy of the Health and Safety Code Handbook 6709.11 and the Pesticide Use Handbook 2109-14 will be provided and reviewed with employees.

General Application

At each site the certified applicator will ensure that:

Herbicides are applied according to the label or according to Forest/Wilderness prescriptions, whichever is more restrictive.

- Crews will periodically calibrate application equipment. Calibration will be documented and provided as part of herbicide application records.
- Application records will meet all FS and State of Idaho requirements and any circumstances which may influence the actual application shall be recorded. This requirement shall be met through the timely completion of treatment records following the FS National Protocol for Weed Treatment Record keeping (FACTS).
- The necessary personal protective equipment is provided and used.
- All full and empty herbicide containers are accounted for and managed accordingly.
- All safety and health requirements are complied with.
- Workers are informed of any required Return Entry Intervals (REI), if any. If necessary, post restricted entry notices at the boundary of the treatment site.

A copy of the product label and material safety data sheet (MSDS) for each herbicide applied will be provided to each person participating in herbicide applications. Copies of the MSDS and labels will be maintained within the facility where the herbicide is permanently or temporarily stored and maintained in the vehicle from which herbicides are applied.

Employees will receive basic training in Hazardous Communications, Hazwoper General Awareness, and appropriate pesticide storage, mixing, use, decontamination, disposal, and spill management procedures (FSM 2161.42).

First aid

- Each crew (or vehicle) will be provided a first-aid kit of sufficient size including emergency eyewash solution.
- Each employee should have a change of clothing with them every day
- Skin contact: Wash exposed area thoroughly with soap and water. Remove saturated clothes and wash contaminated body areas with mild detergent and water.
- Eye contact: Wear splash goggles or face shield during mixing operations and application. If eye contact does occur, immediately flush with water for at least 15 minutes using appropriate eye wash solution. Transport to a physician, provide physician with a copy of the label and MSDS sheet.
- If swallowed: Irrigate mouth and throat with clean water. Induce vomiting only as directed by the label or physician.
- Poison Control Center Phone Numbers:

  Boise Poison Control Center: 1-800-860-0620
  National Poison Control Center: 1-412-681-6669

Hygiene

- Do not smoke, chew tobacco, or eat while spraying. Wash hands before engaging in these activities, and before using the restroom.
- Each crew (or vehicle) will be provided with:
  - A portable eye wash unit capable of delivering 15 minutes of low pressure clean eye wash water. Note: make sure eye wash water is fresh, bacteria in old water is worse than the chemical.
  - A minimum 5-gallon supply of clean water for washing and eye rinse water. Eye rinse water should be in a separated container from general wash water.
  - Adequate soap and towels for washing and drying.
  - Separate drinking water containers for hauling and storing drinking water while in the field. Rinse water will be kept separated from the drinking water.

Personal Protective Clothing (FSH 6709.11)

More stringent requirements may apply on a product-specific basis. Personal Protective Equipment (PPE) regulations specific to herbicide use can be found on labels for herbicides and adjuvants being used and will be the primary guidelines, as allowed for by FSH 6709.11. Personal Protective Equipment will be documented in a Job Hazard Analysis (Form FS-6700-7). Specialized Personal Protective Equipment, such as nitrile gloves, rubber coveralls, and back protectors will be purchased by the program and made available to any employee who wishes to utilize it.

Caring for Personal Protective Clothing

- If herbicides get on clothing, change clothes as soon as possible. Don't wait until the end of the day or until the job is finished. Launder only clothing contaminated with water-soluble low-toxicity pesticides.
- On a daily basis, launder clothing worn during herbicide applications. Herbicide residues in clothing can build up and become more difficult to remove.

- Protective equipment should be washed and dried separately from normal laundry. Avoid additional contact when removing safety clothing.
- Pre-rinse clothing. Pre-rinsing reduces the amount of herbicide in clothing before laundering and minimizes contamination of laundry equipment. Because herbicide formulations usually contain some detergent, it is not necessary to add detergent when pre-rinsing.
- Wash in hot water (140 degrees), use a normal wash cycle and a heavy-duty liquid detergent.
- After every load of herbicide-contaminated clothing, run the machine through a complete cycle with hot water and detergent.
- Line dry laundered garments outdoors.
- Use of disposable protective clothing eliminates the need to launder. Leather items cannot be decontaminated (e.g. boots). Heavily contaminated clothing should not be laundered. The clothing should be placed in plastic bags and disposed of as herbicide-contaminated waste.

Mixing and loading of herbicides

- Personnel handling, mixing or applying herbicides will wear protective clothing and/or equipment as recommended by the manufacturer and required by the label and FS Health and Safety Handbook.
- Mixing and application of herbicides will be done by or under the supervision of a licensed applicator. Crews will mix only the quantity of herbicide anticipated to be needed each day.
- The most hazardous part of applying herbicides occurs during mixing and loading. At these times, the operator is handling the herbicide in its most concentrated form. The following precautions will be implemented:
    - Read and follow the label directions.
    - Wear appropriate protective clothing as described above.
    - Never eat, drink, or smoke while handling herbicides. Before eating or drinking, or using the restroom, always wash hands thoroughly.
    - Do not mix indoors.
    - Do not mix in the wind. If you must, never have the wind in your face.
    - Select a mixing and loading location where, if a spill were to occur, herbicide could be easily contained and would not be likely to enter ground or surface water.
    - Always measure accurately, do not exceed label rates.
    - When pouring, keep the container well below eye level. Always use a pump for large drums.
    - When adding water to the tank, always keep hose or pipe above the level of the mixture.
    - Use catch basins or containment pads when pouring or mixing herbicides.
    - Keep measuring jugs clean and stored properly when not in use.
    - Triple rinse mixing jugs, measuring containers, catch basins and empty herbicides containers. Add rinse water to sprayer.
    - Clean up drips and spills immediately. Use absorbent material to soak up spills. Place absorbed material in separate containers or plastic bags for disposal. Never hose down a spill.

- Keep first aid equipment and at least a 5-gallon supply of clean water readily available, including soap and eye wash equipment.

Transportation

The licensed applicator is responsible for the safe transportation of herbicides. These general safety precautions should be followed to minimize incidents and to mitigate their effects when they do occur.

- Transport from the storage area only the quantity needed for the project, and return any leftover herbicides to the storage area at the end of the project.
- Do not leave vehicles that are transporting herbicides unattended unless it is in a locked or otherwise secure area.
- Transport herbicides with the labeled "warning" on the container facing outward and totally isolated from drivers, passengers, food, or clothing. If the herbicide has been transferred to an unlabeled container, warning labels must be attached to the new container. Warning labels may be obtained from the S-CNF/BLM Interagency Hazardous Materials Coordinator
- Herbicide concentrate containers will be transported in secure compartments.
- When traveling by watercraft, all herbicide concentrate will be transported in watertight compartments that are securely fastened to the craft.
- Secure containers to prevent tipping or excess jarring during transit.
- Make periodic checks during transport to ensure that no spillage has occurred.
- Cover containers to protect them from direct sunlight while in transit to the work site and place them in the shade upon arrival. Excessive heat can cause expansion resulting in container rupture or overflow when opened.
- The specific procedure described in the project safety plans, which are to be used if an accident or spill occurs, shall accompany each shipment of herbicides.
- Do not mix, store or apply herbicides in galvanized steel or unlined steel containers or spray tanks. Highly flammable hydrogen gas could be generated.

Emergency spill plan (FSH 2109-14 Chapter 60)

Prior to beginning operation, the following will be reviewed with the applicators or crews, and placed in the mixing area, storage area, and vehicle.

1. A list of key personnel or agencies, including telephone numbers for potential emergency notification.
    - Local physicians familiar with diagnosis and treatment of herbicide exposure problems
    - Local ambulance service
    - Emergency room locations
    - Poison Control Center, Boise: 1-800-632-8000
    - State DEQ, ESA contacts per direction in NPDES permits and consultation agreements
    - Notification and source of direction for disposal action on spills:
    - Contact Forest and Regional Pesticide Coordinators (Regional Supplement FSH 6709.12)

- Spills involving at least one pint of herbicide **concentrate** and/or five gallons of **mixed** herbicide will be reported to the Ranger District in which work is being conducted. The information will then be forwarded to the appropriate Forest Safety Officer and to the S-CNF/BLM Interagency Hazardous Materials coordinator for appropriate action,
- Spills involving 5 gallons or less of herbicide **concentrate** call:

Dept. of Health and Welfare
Bureau of Hazardous Material
450 West State Street
Boise, ID 837201-208-334-5879

- Spills involving more than 5 gallons of herbicide **concentrate** call:

Idaho State Emergency: 1-800-682-8000

o Location of disposal site for contaminated material:

Envirosafe Services of Idaho, Inc.
Grandview, Idaho
1-800-727-9969

2. **Spill Kits**: A spill kit with directions for use will be strategically placed where spills are most likely to occur and where they can be accessed without traversing a spill site. At least one spill cleanup kit will be available for each crew traveling into the field. A table should list the contents of the kit. The following list recommends contents for spill kits.

   o A vehicle type spill kit will be available at temporary storage facilities.

Vehicle Kit

(Transporting up to 50 gals of product)

Instructions

1 pair rubber or neoprene boots or overshoes
2 pairs neoprene gloves
1 pair unvented goggles
1 pair of coveralls
1 dust pan
1 shop brush
10-30 lbs. absorbent material
1 polyethylene or plastic tarp
1 pint liquid detergent
6 polyethylene bags with ties
1 portable eyewash container
blank labels
ABC-type fire extinguisher
1 garden hose
1 backflow hose attachment

River Corridor and Backcountry Kit

(Transporting 5-20 gals of product)

Instructions
1 shovel
1 dozen polyethylene bags with ties
1 pair unvented goggles
10 lbs. absorbent material
2 pair neoprene gloves
1 pair of coverall

3. **For Supplemental Information Needed on Hazards and Reactions**: Call Chemtrek at 1-800-424-9300. They are an information contact only; do not call them merely to report a spill. For example, if a truck carrying herbicides crashes and ignites, field crews may want to know if any special hazards exist from herbicide fumes – Chemtrek is the appropriate company to call.

Spill Containment and Cleanup

The licensed applicator is responsible for ensuring all cleanup of application operation and spills. After a spill occurs, specific procedures should be followed for cleanup and decontamination of the spill site. In most cases, spill size will dictate the procedure to be followed. The response may vary from a change of personal clothing for minor spills, to decontamination of a road, stream, or ditch bank.

- For any spill, the first step is check for personal injury. The immediate effort should be to assist injured personnel.
- Remove injured personnel from the site to a safe area.
- Remove contaminated clothing from the injured, and the rescuer if necessary, and wash the individuals with detergent and water or clean as specified by the manufacturer.
- Immediately administer first aid and seek medical assistance for injured personnel.

Actions following a spill involving less than 5 gallons of herbicide concentrate (always wear appropriate protective clothing):

1. Determine the extent of the spill.
2. Stop or control the source of the spill. Prevent further leakage by repositioning the herbicide container or by applying a seal to the leak with duct tape, putty or other materials from the repair/patch kit.
3. Separate leaking containers from other containers.
4. If necessary rope off the area and post warning signs to keep unprotected personnel from entering.
5. Confine the spill to prevent it from spreading. Encircle the spill with a dike of absorbent material. If necessary, divert the spill flow away from sensitive areas.
6. Do not flush the spill into a ditch, sewer, drain, or off the road.
7. For liquid spills:

a. Spread absorbent material around the perimeter of the spill and sweep/shovel toward the center.

b. Absorbent material must be disposed of in the same manner as waste pesticide. Shovel spill material into leak proof container for disposal. Label all containers properly and legibly.

8. For dry spills:

   a. Immediately cover powders or dusts with polyethylene plastic or a tarpaulin to prevent the materials from becoming airborne. Spreading can also be minimized by dampening the dust with a fine mist of water.

   b. Clean up by rolling the tarp back little by little while sweeping. Ensure that dust remains dampened.

   c. Shovel the material into a plastic bag or recovery container.

   d. Seal the bags or recovery containers and identify the waste pesticide. Label all bags and containers properly and legibly.

   e. Set the bags or drums aside for subsequent disposal or relabeling if the pesticide can still be used.

9. All contaminated clothing will be removed and washed and dried separately from other clothing

10. Notify the appropriate individuals or agencies on the notification list.

11. Write a report summarizing the spill. Include the following information:

    a. Date, time and cause of the spill

    b. Location and path of the spill

    c. What was spilled and in what quantity (amount of active ingredient)

    d. Pertinent weather conditions that may affect the spill.

    e. Actions taken

    f. People involved

Decontamination

In some cases, the small amount of herbicide remaining after the cleanup process on the road surface or storage area floor must be decontaminated. Soil, roadways, tools, and nonporous surfaces should be decontaminated in the following manner.

Soil: Heavily contaminate soil should be removed to a depth of at least 2 inches below the contaminated zone and placed in drums for disposal.

Roadways, floors, and other nonporous surfaces: Spread the appropriate decontamination material on the spill and work it into the surface using a coarse broom. Allow the decontaminant to sit for 2 hours. Pick up the decontamination material by spreading fresh absorbent material around the perimeter of the spill area, sweeping it toward the center, and shoveling it into plastic bags or drums.

Wood or other porous material: Discard or destroy porous material and equipment such as brooms.

Decontamination Solution: If any questions arise about decontamination solutions, the herbicide manufacturer should be contacted.

- Mild alkalis are soda ash (sodium carbonate); baking soda (sodium bicarbonate); household ammonia; and limestone (calcium carbonate). For safety, a preliminary test should be made on which very small amounts of the herbicide and alkali are mixed and observed to make sure the reaction is not too vigorous.

Disposal

Empty herbicide containers are never completely empty. Never leave containers at the application site. Never give herbicide containers away. **Do not use empty containers for unauthorized purposes**. Container labels describe disposal requirements and must be followed. Where triple rinsing is required by the label, triple rinse empty containers as follows:

1. Empty the container into the spray tank. Let it drain for 30 seconds.
2. Fill the container one-fourth full of water. Replace the lid or cap and rotate the container. Invert the container so the rinse reaches all inside surfaces.
3. Drain the rinse water into the spray tank. Let it drain at least 30 seconds.
4. Repeat the rinse process, two more times for a total of three rinses.
5. Crush and punch holes or render the container unusable.
6. Dispose of empty containers using FS compound dumpsters or the EPA container recycling program**.**

Temporary Storage Facilities

For the purpose of the weed management program, long term storage is the storage of any unused herbicide longer than the field season of use in an approved storage facility.

Herbicides that are being used will not be stored or left overnight except at temporary storage facilities approved by the official in charge of the operation or locked in the approved vehicle. Unused herbicide will be returned to the storage facility at the end of each work day. The following precautions will be taken for temporary storage:

- Identification and warning signs will be placed on buildings and trucks to advise of the contents of the stored material.
- Herbicides will be protected from direct sunlight or inclement weather.
- At least 10 gallons of clean water and soap for decontamination of personnel will be available at each temporary storage site.
- An ABC-type fire extinguisher will be readily available at the storage facility.
- Herbicide containers will be stored in a secondary container or tray with 1 ½ times the volume of the stored herbicide container.
- Herbicides will not be stored above non-herbicide containers or equipment.
- Herbicides will be stored separately from Personnel Protective Equipment.
- Temporary storage facilities are to be inspected annually and the inspection checklist filled out (FSH 2109.14, 40 41.11)

Appendix C: Salmon-Challis Forestwide Integrated Weed Management Prevention Plan

Introduction

It has been well-established that the most effective method for managing noxious weeds is to prevent their invasion and expansion. Prevention is the most economical and ecologically sound method for weed management. However, no single element of Integrated Weed Management (IWM) operates independently. Within prevention are aspects of education, early detection, on-going monitoring, site restoration, general land use practices, and other elements of IWM. All elements of IWM are inter-connected in a variety of relationships. The challenge and the primary goal of IWM is to incorporate a variety of strategies in a coordinated, multi-disciplinary, ecological approach with the goal of maintaining or developing healthy plant communities that are relatively weed-resistant.

Prevention Aspects of Integrated Weed Management

The primary focus of this prevention plan is the prevention/education element of IWM. The goal is to increase public and agency personnel awareness about the noxious weed issue. To be most effective, the elements of IWM should not function independently. For example, prevention goes well beyond public education. The prevention aspects of other elements of IWM are highlighted below to illustrate the multi-disciplinary approach.

Inventory

- Continuing Inventory efforts provide the opportunity for repeated field visits and the detection of new invaders and new infestations of established species. Identification of weed-free areas provides baseline data on healthy, intact ecosystems.

Treatment

- Treatment practices restrict the encroachment of noxious weeds onto adjacent lands.
- Treatment practices limit the number of seeds produced and/or inhibit rhizomatous growth.

General Land Management Practices

- Minimizing soil disturbances by vehicles, machinery, wildlife, livestock, and recreation impacts is central to preventing weed establishment.

Monitoring/Evaluation

- Annual Monitoring efforts provide evaluation of effects of various treatments on weed populations and non-target resources and determine population trends such as expansion rates and habitat susceptibility.
- Adaptive strategies can be determined and implemented to maximize prevention efforts.

Partnerships/Coordination

- Information-sharing and a coordinated/cooperative approach within and outside the agency allow for a broad, regional perspective and rapid response to new infestations.
- The process of educating and motivating individuals to promote noxious weed management and prevention has positive, long-term, compounding effects.

Restoration

- Establishment of competitive, healthy plant communities in areas susceptible to invasion hinders the introduction or re-introduction of noxious weeds.

Prevention is one element of all the interrelated elements of Integrated Weed Management. A coordinated approach of a variety of tactics is the primary strategy of IWM.

1. Forest User Group's Education and Prevention Practices

Forest access and recreation are two of the primary means of introduction and continuing spread of weed infestations. Some of the most common areas in which weed infestations become established on the Forest are along Forest roads, trail systems, boat launches, and in and around designated and dispersed camps. To reverse this trend, a well-planned, comprehensive education program targeted at Forest users is necessary.

The lists below outline education measures and prevention practices targeted at particular user groups. The intention is to have representatives of the various user groups and other stakeholders implement measures to reach their constituents. These lists should not be considered a finalized plan. They are provided as examples of the extensive variety of education options available for development and implementation.

All Users including Forest Service Personnel

Action Items:

- General noxious weed information and specific management actions posted at strategic locations such as trailheads, roads, boat launches, information kiosks, and forest portals.
- Make a variety of weed materials (brochures, identification cards, etc.) available to users at SCNF offices.
- Establish network of volunteer groups, individuals, outfitters, and landowners for treatment, inventory, and logistical support.

Specific Prevention Practices:

- Clean all equipment and transportation aids before traveling into the Forest and after leaving.

Water Recreation Users

Action Items:

- Post general noxious weed information and specific management actions at all launch sites.
- Noxious weed information included when purchasing fishing licenses.
- Encourage users to clean boots and equipment before traveling to a new area.

- Provide Interpretation and Education (I&E) materials to river-based outfitters and guides.
- Provide I&E materials to recreation associations (Western Whitewater, Idaho Whitewater Association, etc.).

Specific Prevention Practices:

- Clean all boats, trailers, vehicles, and equipment before and after using water systems.
- Know how to identify noxious weeds and where to report observations of infestations.
- Interstate boat transport to comply with the Idaho Boat Inspection Program
- Boaters to comply with Idaho State Invasive Species sticker requirement.

Motorized/Mechanized Road and Trail Users

Action Items:

- Post general noxious weed information and specific management actions at all trailheads and portals.
- In weed-infested areas, post weed awareness messages and prevention practices at roadsides.
- Include I&E materials on travel plan maps.
- Provide I&E materials to and coordinate implementation of prevention practices with local and regional recreation associations.

Specific Prevention Practices:

- Inspect and clean motorized and mechanized trail vehicles of weeds and their seeds before and after using Forest roads and trails.

Horsepackers /Backpackers

Action Items:

- Enforce Intermountain Region weed free hay closure (04-00-97).
- Post general noxious weed information and specific management actions at all trailheads and portals.
- Include I&E materials on travel plan maps.
- Enforce weed seed free feed regulation.
- Provide I&E materials to and coordinate implementation of prevention practices with recreation associations such as Backcountry Horseman and other regional recreational groups.
- Coordinate with State agencies and their education efforts to increase compliance with the certified weed-seed free feed regulation.
- Make I&E materials available at outdoor and feed/stock supply retailers.
- Develop and provide I&E package to hunting and pack-trip outfitters.

Specific Prevention Practices:

- Avoid traveling through and camping on weed infestations.

- Pack and saddle stock users should feed stock only weed-free feed for several days before initiating use of National Forest System lands.
- Inspect, brush, and clean animals, especially hooves, legs, manes, and tails, before entering public land.
- Tie or hold stock in ways that minimize soil disturbance and avoid loss of native vegetation.
- Brush and clean pets before and after using Forest System lands. Keep pets from traveling through noxious weed infestations.
- Clean boots and equipment before traveling to or camping at a new area.

Forest Resource Users (firewood, mushrooms, etc.)

Action Items:

- Include noxious weed I&E and prevention practices on woodcutting/mushroom picking maps.
- Provide noxious weed information and prevention practices to users at time of permit purchase.

Specific Prevention Practices:

- Avoid traveling through weed infestations.
- Inspect and clean vehicles of weeds and their seeds before and after using Forest roads and trails.
- Clean boots and equipment before traveling to a new area.

Hunters

Action Items:

- Incorporate noxious weed information into Hunter Education courses, IDFG Check Stations, and during hunting license purchase.
- Make I&E materials available at outdoor supply retailers.
- Coordinate prevention measures with the Idaho Department of Fish and Game.

Specific Prevention Practices:

- Avoid traveling through weed infestations.
- Inspect and clean vehicles of weeds and their seeds before and after using Forest roads and trails.
- Clean boots and equipment before traveling to or camping at a new area.
- Know prevention practices for motorized/mechanized/stock users as applicable.

Other Audiences

The following is a list of prevention and education measures targeted to a more general audience. While these efforts may not specifically address Forest Service personnel and Forest users, they are included in this prevention plan because of their inherent value. Other audiences (children, community, and volunteer groups) may benefit from noxious weed prevention and education.

Action Items:

- Initiation of Cooperative Weed Management Areas (CWMAs) to coordinate management efforts with state and federal initiatives.
- Completion of display board depicting species identification, the impacts of noxious weeds, and the Salmon-Challis National Forest Prevention Plan for use at County Fairs, conferences, annual meetings, and in Forest Service offices.
- Post prevention practices and I&E materials at trailheads and developed recreation facilities, provide information to user groups, and have education material available at Forest offices and on the website.
- Survey of noxious weed I&E materials by Student Conservation Association crew.
- Variety of programs in local school systems.
- Coordinate prevention efforts with other agencies. Continue work with federal, state, county, and other interested partners to develop additional educational materials.
- Discuss weed prevention practices at permittee and cooperator meetings, and at contractor pre-work sessions, where applicable.
- Design of a web page for noxious weed management on the Forest.
- Television and/or radio segments dealing with weed prevention.
- Newspaper articles and layouts dealing with weed prevention.
- Development of multi-media program(s) for presentation to interested parties.

2. Internal Education and Prevention Practices

Internal education refers to the process of training employees and representatives of the agency in the various elements of IWM. Agency personnel, both permanent and seasonal, must be informed about the conditions under which weeds become established, how weeds are spread, and the effects weeds have on all resources. Implementing this knowledge can minimize weed spread because of resulting altered land management activities. Personnel should be encouraged to incorporate weed prevention and control messages into their day-to-day work priorities and appropriate public information materials.

Some particular messages to be communicated through the process of internal education are as follows:

- Prevention is part of every employee, contractor, and volunteer's job.
- Weeds can be spread by many land management activities and are detrimental to many activities on public lands.
- Integrating preventive measures into daily and authorized activities can improve the health of the land at little cost.
- Integrating prevention messages into informational materials will raise awareness at little additional cost.
- Weeds are spreading at an alarming rate--ignoring them is not an option.
- Working with partners in the weed control effort is vital to helping improve the health of the land.
- Using pilot projects and demonstration areas, education and outreach efforts will help illustrate the nature of the problem and options for dealing with it.

The objectives of the prevention and control measures are to reduce the risk of spreading noxious weeds, prevent the establishment of new invaders, integrate weed management into all resource programs, and build awareness within the agency. A challenge to managers is to

ensure that the strategies outlined are being implemented on the ground by all agency personnel.

3. Prevention and Control Measures

The following prevention and control measures are from the 2080 Noxious Weed Management Region 4 2000-2001-1 Supplement. These measures were removed from the Forest Service Manual when the 2900 regulations replaced the 2080 regulations. Until such time that prevention and control methods are included under the 2900 regulations, the Salmon-Challis National Forest will continue to incorporate the following practices into forest activities.

1. Recommended Practices. Stop the spread of existing noxious weeds and prevent invasion of new sites or new noxious weeds by applying prevention and control mitigation measures where applicable and appropriate. Potential practices to consider:

a. Project Design and NEPA. Incorporate noxious weed prevention into all project layout, design, and alternative evaluation.

   Environmental analyses should consider noxious weed risk in evaluating project location and design, and in the development of alternatives and mitigating measures, including any or all of the following, as determined to be appropriate by the Forest Officer in charge:

   1. The presence of existing noxious weeds within the project site by species and magnitude.
   2. The susceptibility of the habitat type to noxious weed invasion.
   3. The risk for invasion or spread of noxious weeds that could be caused by the project.
   4. The evaluation of alternative sites, which are noxious weed-free and/or low risk, for project implementation.
   5. The evaluation of alternative implementation methods where they exist, which would reduce risk of invasion or spread of noxious weeds.
   6. The inclusion of other mitigation measures (practices) designed to minimize risk of invasion or spread of noxious weeds.
   7. The evaluation of direct, indirect, and cumulative effects of the project to noxious weed species and populations.

b. Ground Disturbing Activities. Project implementation for ground-disturbing operations within noxious weed infested areas, as deemed appropriate, should include provisions for monitoring and inspecting as determined through the analysis process.

   1. Comply with mitigation measures for ground disturbing operations within noxious weed infested areas which are generally recommended by the Forest or District Weed Management Specialist and approved by the responsible Forest Officer.
   2. Select noxious weed-free project construction staging areas.
   3. Maintain as much microhabitat for desirable vegetation as feasible in areas that will have ground disturbance to help suppress noxious weeds. Minimize the removal of trees and other roadside vegetation during construction,

reconstruction, and maintenance, particularly on southerly aspects, except when removal is required for public safety.

4. Re-establish vegetation (native where practical) on bare ground caused by ground-disturbing activities to minimize noxious weed spread. Guidelines to consider include:

    a) Revegetate disturbed soil in a manner that optimizes plant establishment for that specific site, unless ongoing disturbance at the site will prevent noxious weed establishment or spread. Monitor and re-treat as needed until site is successfully revegetated according to project standards.

    Exceptions to this mitigation measure should require monitoring and treatment of invading noxious weeds. Exceptions include:

    Grading and blading of travel ways, borrow ditches, rights-of-way, and drainage ways on system roads that are routinely maintained.

    Areas where management objectives would be adversely affected by seeding grass species, that is: reforestation plantations.

    b) Weed seed free topsoil should be stockpiled and replaced on disturbed areas such as road embankments, cuts, fills, and shoulders; gravel pits; skid trails; landings; staging areas; and so forth, where practical.
    c) Replant as soon as practical after the disturbance activity to take advantage of the seedbed and to establish desirable species before the arrival of invading noxious weeds. Use local seeding recommendations. To avoid weed contaminated seed, each lot shall be tested by a certified seed laboratory against the State Noxious Weed List and documentation of seed inspection test provided for.
    d) Use local seeding guidelines for detailed procedures and appropriate mixes. If the risk for invasion by noxious weeds is high, use aggressive, early season species. If the risk is low, use a more diverse mixture of native species that may take longer to establish. Include natives, pioneer species, and/or nurse crops. Select for low nutrient demanding species to reduce the need for fertilization. Monitor seeded sites. Spot re-seed as needed.

5. Restoration practices for disturbed areas should be based on local prescriptions.

6. Use certified weed-seed free straw and mulch on road stabilization and erosion control projects.

7. Eliminate the movement of existing and new noxious weed species caused by moving infested gravel and fill material.

    a) Consider the potential for moving noxious weeds when establishing new material sources on sites where noxious weeds are present, and take necessary corrective action.
    b) Active gravel and borrow sources should be inspected and determined to be noxious weed free before use. A source supporting noxious weeds should be considered for closure until it is weed free.

c. Roads and Road Work. Minimize roadside sources of noxious weed seed that could be transported to other areas, and maximize effectiveness of weed control.

   1. Ranger District noxious weed prevention and control programs should include a monitoring plan for annual inspection of system roads and rights-of-way for invasion of noxious weeds. If noxious weeds become established, inventory and schedule for treatment.
   2. Schedule and coordinate blading or pulling of noxious weed-infested roadsides or ditches with the Forest or District Weed Management Specialist to ensure that appropriate mitigation measures are applied. Coordinate with a weed management specialist before blading or pulling roadsides and ditches infested with noxious weeds that are on the routine maintenance schedule.
   3. When necessary to blade noxious weed infested roadsides or ditches, schedule work for spring or early summer prior to the seed-set stage or later in the fall after seeds have fallen. Minimize surface disturbance and isolate bladed material to the infested site. (Also see item b. Ground Disturbing Activities above).

d. Reclamation/Restoration. Reduce noxious weed establishment in obliteration/reclamation projects. Treat noxious weeds in obliteration and reclamation projects before roads are made undriveable. Monitor and retreat as necessary. (Also see item b. Ground Disturbing Activities above).

e. Public Use. Minimize transport and establishment of noxious weeds on National Forest System lands by considering these preventive measures:
   1. Treat noxious weeds at trailheads, boat launches, outfitter and public campsites, airstrips, and roads leading to trailheads.
   2. Close infestations of noxious weeds to camping until noxious weeds have been eradicated.
   3. Inspect campgrounds, trailheads, and similar areas that are open to public vehicle use and consider as high-risk areas. Inspect annually for invasion of noxious weeds. Include established infestations in strategies for eradication.
   4. Remove seed sources that could be picked up by passing vehicles to limit seed transport. (Also see item b. Ground Disturbing Activities above).

f. Noxious weed awareness and prevention efforts.
   1. Use education programs to increase noxious weed awareness and prevent noxious weed spread by Forest users.
   2. Post and enforce the statewide Noxious Weed Hay, Straw, and Mulch Closure Order.
   3. Post pictures and descriptions of noxious weeds at National Forest System trailheads and at roadsides in noxious weed areas to inform recreationists of noxious weed presence and dangers of spreading.
   4. Post prevention practices at National Forest System trailheads and at roadsides in noxious weed areas. Recommended prevention practices include:
      a) Pack and saddle stock should be fed only weed-seed free feed for several days prior to traveling off roads in the Forest and should be brushed to remove any noxious weed seed.

b) Stock should be tied and held in the backcountry in such a way as to minimize soil disturbance and avoid loss of native/desirable vegetation.
c) Motorized trail users should inspect and clean their vehicles of noxious weeds and their seeds prior to using National Forest System lands.

5. Post notices in publicly accessible noxious weed treatment areas where and when there is a likelihood of contact with herbicide-treated- vegetation.

g. Archeological Excavations. Reduce noxious weed establishment and spread at archeological excavations. Archeological excavation areas are considered as high-risk ground disturbing areas and should be inspected for invasion of noxious weeds. If noxious weeds become established, they should be inventoried and scheduled for treatment. (Also see item b. Ground Disturbing Activities above).

h. Wildlife and Fisheries. Ensure noxious weed prevention and control is considered in management of wildlife and fisheries. Forest noxious weed prevention and control programs should include a monitoring plan for inventory and annual inspection of areas where wildlife concentrate in the winter and spring, which results in overuse and/or soil scarification. Inventory and schedule for treatment noxious weeds when found. (Also see item b. Ground Disturbing Activities above).

i. Domestic Grazing Activities. Ensure noxious weed prevention and control is considered in management of all grazing allotments. Consider the following:

1. Annual Operating Instructions for every grazing allotment should include noxious weed prevention monitoring and reporting direction, and provisions for annual inspection of areas where livestock concentrate, which results in overuse and/or soil scarification. If noxious weeds become established, they should be inventoried and scheduled for treatment.

2. For each grazing allotment containing noxious weed infestations, include direction in the Annual Operating Instructions (AOI) for prevention and control of noxious weeds. Items to be addressed in the AOI might include: season of use, exclusion, minimizing ground disturbance, noxious weed seed transportation, maintaining healthy vegetation, control methods, revegetation, monitoring, reporting, and education.

   Include ways to minimize ground disturbance and bare soil caused by livestock operations (for example: salt licks, watering sites, yarding/loafing areas, corrals, and other heavy use areas) in Allotment Management Plans (AMPs) and/or Annual Operating Instructions.

   Minimize transport of noxious weed seed into and within allotments by considering the following:

   a) Avoid driving, walking, riding, and/or herding through noxious weed infestations.
   b) Entry units grazed by livestock transported onto the Forest from noxious weed-infested areas should be inspected annually for new noxious weeds. If noxious weeds become established, they should be inventoried and scheduled for treatment.

3. Maintain healthy desirable vegetation that is resistant to noxious weed establishment by considering the following:
    a) Manage forage utilization to maintain the vigor of desirable plant species as described in the Allotment Management Plan.
    b) Minimize and/or exclude grazing on restoration areas until vegetation is well established.
4. Promote noxious weed awareness and prevention efforts among livestock permittees by considering the following:
    a) Use education programs and/or Annual Operating Instruction direction to increase noxious weed awareness and prevent noxious weed spread by permittees' livestock and/or management activities.
    b) Encourage permittees who are certified herbicide applicators to participate in allotment and Cooperative Weed Management Area noxious weed control programs. (Also see item b. Ground Disturbing Activities above).

j. Forest Management. Minimize the creation of sites suitable for noxious weed establishment during timber harvest by considering the following:
    1. Avoid driving, walking, skidding, landing, and/or hauling through noxious weeds.
    2. Minimize soil disturbance during forest management operations by considering winter skidding; broadcast burning over pile burning; smaller slash piles and burning under conditions that minimize heat transfer to the soil; minimizing fire line construction; seeding skid trails, landings, and other disturbed sites.
    3. Monitor for noxious weeds after sale activity and treat noxious weeds as needed.
    4. Where logging activity on planned or existing timber sales may contribute to the encroachment of noxious weeds, use Sale Area Improvement and K-V collections to control or prevent the encroachment of noxious weeds within sale areas as provided for in FSM 2477. Enter planned expenditure of K-V funds for noxious weed control on Development and Budget System Plan. (Also see item b. Ground Disturbing Activities above).

k. Mining, Mineral, Oil and Gas. Minimize noxious weed establishment in mining operations and reclamation by considering the following:
    1. Retain sufficient bonding until an appropriate percent of the potential vegetation ground cover, as determined by the responsible Forest Officer, for the site is reestablished.
    2. Mining and mineral exploration areas are considered as high-risk areas and should be inspected for invasion of noxious weeds. If noxious weeds become established, they should be inventoried and scheduled for treatment. (Also see item b. Ground Disturbing Activities above).

l. Soil and Watershed Improvement. Integrate noxious weed prevention and management in all soil and watershed, and stream restoration projects. Forest noxious weed prevention and control programs should include a monitoring plan for early detection of noxious weed spread or establishment in riparian areas, particularly from existing infestations and previously eradicated sites. New infestations should be treated

for eradication before they become well established. (Also see item b. Ground Disturbing Activities above).

m. Special Use Permits and Easements. Reduce noxious weed establishment and spread in special use permits and easements by considering the following:
    1. Holders of special use permits and easements are responsible for the prevention and control of noxious weeds on the area authorized when prescribed by the Forest Service.
    2. Require noxious weed prevention and control requirements in Operating and Maintenance Plans when authorized activities present a high risk for invasion by noxious weeds or the location of the activity is vulnerable to invasion by noxious weeds.

n. Wildfire and Prescribed Fire Operations. Mitigate and reduce noxious weed spread during wildfire and prescribed fire operations by considering the following:
    1. Increase noxious weed awareness among fire personnel. Include noxious weed risk factors and noxious weed prevention considerations in the Resource Coordinator duties on Incident Overhead Teams and Fire Rehabilitation Teams.
    2. Where practical and timely, establish fire camps, vehicle and crew staging areas, helibases, helispots, cargo and net loading areas, and airstrips in noxious weed-free areas.
    3. Assign a local Weed Specialist Resource Advisor to the Incident Command Team when the wildfire or control operation occurs in or near a noxious weed area.
    4. When noxious weed infested areas are used for fire operations, implement appropriate mitigation measures, as determined by the Weed Specialist Resource Advisor. Identify high-risk noxious weed infestations in areas of fire operations, and avoid when possible.
    5. All vehicles sent off Forest for fire assistance in noxious weed areas should be cleaned before returning to home units.
    6. Emphasize Minimal Impact Suppression Tactics (MIST) to reduce soil and vegetation disturbance. Minimize fire and dozer line.
    7. Avoid or minimize all types of travel through noxious weed areas.
    8. Avoid ignition and burning in noxious weed areas, unless it is part of a noxious weed control strategy.
    9. Avoid ignition and burning in areas with a high risk for invasion of noxious weeds.
    10. Unplanned burning of noxious weed areas might require post treatment of noxious weed infestations.
    11. Utilize noxious weed-free helibases and helispots for aerial ignition projects.
    12. Minimize fireline and soil disturbance and:
        a) Encourage desirable vegetation during fire rehabilitation activities.
        b) Seed the entire burn, all cat lines, and severely disturbed areas when there is a high risk of noxious weed spread or invasion, and such action is recommended by the local Weed Specialist Resource Advisor and approved by the Responsible Forest Officer.
        c) Prioritize treatment of noxious weeds on fire access roads as part of rehabilitation plan to reduce noxious weed spread into burned areas.

13. Apply for restoration funding for noxious weed infestations as determined by Burned Area Rehabilitation teams. (Also see item b. Ground Disturbing Activities above).

o. Noxious Weed Program Continuity. Ensure continuity in noxious weed management programs. Each Forest should have access to a Weed Specialist who is trained and proficient in noxious weed management.

2. Closure Orders. Product certification shall be accepted from any State Department of Agriculture, County Agriculture Officer, or their authorized agents, on National Forest System lands for the certified hay, feed, straw, and mulch closure orders. Pelletized feed does not fall under the hay products closure orders.

Appendix D: Adjuvants

Adjuvants are specially designed chemical solutions that are added to an herbicide solution to improve the performance of the total spray mixture. Adjuvants are not regulated by the EPA in the same way that pesticides are. The EPA does not register or approve the labeling of spray adjuvants. Field testing is generally completed by the adjuvant manufacturer (Bakke 2007). Labels accompanying adjuvants describe their properties and prescribe use rates. Information on types of adjuvants to use can also be found on herbicide labels and in publications by university extension services (Prather et al. 2011, Zollinger 2012, Peachey 2012).

Post-emergence herbicide effectiveness depends on spray droplet retention and herbicide absorption by weed foliage. Adjuvants and spray water quality influence post-emergent herbicide efficacy (USDA Custer National Forest 2006).

"Activator" adjuvants enhance activity of an herbicide's active ingredient, while "special purpose or utility modifier" adjuvants offset common problems occurring during application, including poor water quality or foam produced during agitation of the spray mixture (Bakke 2007). Many adjuvants have properties that place them on a continuum between these two definitions and function both as activators and utility modifiers. Adjuvants used in the SCNF are identified in Table D-2.

Special purpose or utility adjuvants are used to offset or correct certain conditions associated with mixing and application such as impurities in the spray solution, extreme pH levels, and drift. These adjuvants include acidifiers, buffering agents, water conditioners, anti-foaming agents, compatibility agents, and drift control agents. Acidifiers enhance absorption of weak acid type herbicides. Drift reduction agents will generally increase the average droplet size. Defoamers reduce foaming that occurs during agitation of the spray mixture. Colorants or dyes help applicators determine what area was treated. This helps to prevent skips and overlaps and treatment of non-target areas. They reduce the chance of human exposure to recently treated vegetation (Bakke 2007).

Surfactants (surface active agents) are a broad category of activator adjuvants designed to improve or facilitate the dispersing/emulsifying, absorbing, spreading, sticking and/or pest-penetrating properties of the spray mixture. Pure water will stand as a droplet, with a small area of contact with the waxy leaf surface. Water droplets containing a surfactant will spread in a thin layer over a waxy leaf surface (Bakke 2007).

Because post-emergence herbicide effectiveness is greatly influenced by plant factors such as age, size and the growing conditions encountered before application, herbicide performance can vary. A way to minimize the variations in post-emergence herbicide performance is to use an adjuvant or surfactant in the spray solution. Adjuvants, specifically surfactants, generally improve the effectiveness of post-emergence herbicides. Typically, surfactants are not added to herbicides that are soil applied (pre-emergence) (Zollinger 2012). Surfactants used on the SCNF include non-ionic surfactants, methylated or ethylated vegetable oils, nitrogen sources, and organosilicone/silicone surfactants.

Non-ionic surfactants (NIS) are all-purpose surfactants comprised of linear or nonyl-phenol alcohols and/or fatty acids. This class of surfactant reduces surface tension of water and improves spreading, sticking and herbicide uptake (USDA Custer NF 2006). Often, non-ionic surfactants will have additional additive properties, as described on their label.

Methylated or Ethylated vegetable (seed) oils (MSO) are produced by reacting fatty acids from seed oils (corn, soybean, sunflower, and canola) with an alcohol to form esters. The methyl or ethyl esters produced by this reaction are combined with surfactants/emulsifiers to form esterified seed oil. These surfactants reduce surface tension of water and improve herbicide uptake by improving herbicide distribution on the leaf surface (USDA Custer NF 2006). Adverse environmental conditions such as low humidity, hot weather, lack of rain, drought-stressed weeds, or weeds not actively growing due to some environmental stress favor the use of MSO. The North Dakota State University Weed Control Guide suggests that these oils are more effective than non-ionic surfactants as an adjuvant to post-emergence herbicides (Zollinger 2012).

Nitrogen sources typically consist of premixed combinations of various forms of nitrogen and surfactants. They generally are used with herbicides recommending the addition of ammonium sulfate or 28 percent nitrogen. These surfactants reduce surface tension of water and improve leaf surface spreading (Miller and Westra 1998). They are used primarily with broadleaf herbicides. Fertilizers containing ammonium nitrogen have increased the effectiveness of herbicides like glyphosate, and 2, 4-D amine. Fertilizer applied with other herbicides may reduce weed control or cause crop injury. Some fertilizers enhance non-target plant growth to stimulate competition from weed species re-establishing. Fertilizers should be used with herbicides only as indicated on the label or where experience has proven acceptability (USDA Custer NF 2006).

Organosilicones and silicone surfactants are two types of nonionic surfactants. Organosilicone surfactants drastically reduce surface tension of water to the point where the herbicide droplets thin and coalesce to form a thin layer on the leaf surface (known as “superspreading”). In addition, this class of surfactant provides improved effectiveness through maximum rainfastness (Tu et al. 2001).

Table D-1: Recommended Adjuvant Type by Herbicide[1]

Herbicide	Recommended adjuvant types
2,4-D	NIS, fertilizer, crop oil concentrate (COC)
Aminopyralid	NIS
Chlorsulfuron	NIS, seed oil, organosilicone
Clopyralid	NIS, COC
Dicamba	Any as allowed by label
Glyphosate	NIS
Imazamox	NIS, seed oil, organosilicone
Imazapic	NIS, seed oil, organosilicone
Imazapyr	NIS, seed oil
Metsulfuron methyl	NIS, seed oil, organosilicone
Picloram	None needed but can add as per surfactant manufacturer’s label
Sulfometuron methyl	Any allowed by label
Triclopyr triethylamine salt (TEA)	NIS

[1]Recommended by Peachey 2012, Prather et al. 2011, and product labels.

Table D-2: Adjuvant Type, Class, Product, and Product Manufacturer[2]

Adjuvant Type	Category	Product Name	Product Manufacturer	Principal Functioning Agents	Use Range	Signal Word	Comments
Activator	Non-ionic surfactant (NIS)	Activator 90	Loveland	Alkylphenol ethoxylate, alcohol ethoxylate and tall oil fatty acid	0.125-0.5%	Caution	Low foam, biodegradable, non-flammable
		R-11	Wilbur-Ellis	Alkylphenol ethoxylate, butyl alcohol, dimethylpolysiloxane	0.063-1%	Warning	Spreader, activator
		Spreader 90	Loveland	Alkylpolyethoxy ethers and ethoxylated derivatives	8-64 oz/100 gal	Warning	Spreader
		Super Spread 90	Wilbur-Ellis	Alkyl aryl polyoxyethylene glycols and free fatty acids	0.25-0.5%	Caution	Spreader
Activator	Basic Blend *and* Methylated or Ethylated Vegetable Oil *and* Nonionic Surfactant *and* Nitrogen Source	Renegade	Wilbur-Ellis	Modified vegetable oil, ammonium solution, nonionic surfactant	1-2.5%	Warning	Unique blend, high load of Nitrogen
Activator	Methylated or Ethylated Vegetable Oil	MSO with Leci-Tech	Loveland	Methylated seed oils plus emulsifying surfactants	1-2 pt/A	Caution	MSO and non-ionic
Activator	Methylated or Ethylated Vegetable Oil *and* Organo-Silicone	Syl-tac	Wilbur-Ellis	Organosilicone/ modified vegetable seed oil	0.125-0.375%	Caution	
		Phase	Loveland	Methylated seed oil plus organosilicone surfactant	0.125-0.5%	Caution	

Adjuvant Type	Category	Product Name	Product Manufacturer	Principal Functioning Agents	Use Range	Signal Word	Comments
	Surfactant						
Activator *and* Utility Modifier	Nonionic Surfactant *and* Buffering Agent or Acidifier	Super Spread 7000, LI 700	Wilbur-Ellis	Alkyl aryl polyoxyethylene, ethoxylated alcohols, aliphatic polycarboxylate	0.25-4 pt/100 gal	Caution	
Utility Modifier	Colorant	Hi-Light	Becker-Underwood	Proprietary blue colorant	6-32 oz/100 gal	Caution	
		Bullseye	Milliken Chemical	Proprietary blue colorant	0.5 oz/gal	None	
Utility Modifier	Water Conditioning Agent *and* Buffering Agent or Acidifier	Bronc Max	Wilbur-Ellis	AMS/ammonium alkyl aryl sulfonates, polycarboxylic acid	0.125-1%	Caution	Ammonium sulfate (AMS) replacement
Utility Modifier	Water Conditioning Agent	Choice Weather Master	Loveland	Blend of salts of polyacrylic, hydroxy carboxylic, propionic acids, phosphate ester, ammonium sulfate	0.25-0.5%	Caution	AMS, water conditioner

[2]Products currently used in the SCNF. For information on the process for adding adjuvants to the list, see section on adaptive management.

Toxicity of Adjuvants

"Normal" environmental exposure levels of surfactants and emulsifiers to humans, however, would appear to be negligible based on the extremely high dosages that are typically necessary to cause toxic responses in mammals (Tu et al. 2001). Testing of LD_{50} (lethal dose, 50% kill) on a range of wildlife shows that while some adjuvants are toxic to wildlife at small concentrations, others are considered "practically nontoxic."

LC_{50} (lethal concentration, 50% kill) Classification (MDAR 2004)
<1 mg/l: HT (Highly Toxic)
1-10 mg/l : MT (Moderately Toxic)
10-100 mg/l: ST (Slightly Toxic)
100, 1,000 mg/l: PN (Practically Nontoxic)
>1,000 mg/l: IH (Insignificant Hazard)

Table D-3: Standard Acute Aquatic Species Toxicity Testing Results (Bakke 2007)

Name	Rainbow Trout 96-hour LC_{50}	Bluegill 96-hour LC_{50}	Daphnia 48-hour EC_{50}	Toxicity Level (done by MM)
Ethoxylated fatty amines				
Alkylphenol ethoxylate-based wetter/spreaders				
R-11®	3.8 – 6 mg/L NOEC 1 mg/L	4.2 mg/L NOEC 1 mg/L	5.7 - 19 mg/L NOEC (population size) 0.25 mg/L	Moderately toxic to fish
Activator 90	NA 1.4 (MDACR 2004)	Guppy (*Poecilia reticulata*?) 12.7 mg/L, NOEC 5.8 mg/L	5.2 mg/L (24 hour) NOEC 1 mg/L	MT
Silicone-based wetter/spreaders				
Sylgard® 309	NA	Fathead minnow >4.6 mg/L	22.9 to >41 mg/L (zero population growth con'c = 18 mg/L)	
Dyne-Amic®	NA	26.9 mg/L	NA	ST
Sticker/Spreaders				
Oils				
MSO®	NA	NA	NA	
Hasten®	74 mg/L	NA	>50 mg/L	Slightly toxic to trout
Blends of vegetable oils and silicone-based surfactants				
Syl-tac™	>5 mg/L	NA	>5 mg/L	MT-ST
Phase™	NA	NA	NA	

Table D-4: Standard Acute Aquatic Species Toxicity Testing Results (Bakke 2007)

Name	Rainbow Trout 96-hour LC_{50}	Bluegill 96-hour LC_{50}	Daphnia 48-hour EC_{50}	Toxicity Level (done by MM)
Ethoxylated fatty amines				
Alkylphenol ethoxylate-based wetter/spreaders				
R-11®	3.8 – 6 mg/L NOEC 1 mg/L	4.2 mg/L NOEC 1 mg/L	5.7 - 19 mg/L NOEC (population size) 0.25 mg/L	Moderately toxic to fish

Name	Rainbow Trout 96-hour LC_{50}	Bluegill 96-hour LC_{50}	Daphnia 48-hour EC_{50}	Toxicity Level (done by MM)
Activator 90	NA 1.4 (MDACR 2004)	Guppy (*Poecilia reticulata*?) 12.7 mg/L, NOEC 5.8 mg/L	5.2 mg/L (24 hour) NOEC 1 mg/L	MT
Silicone-based wetter/spreaders				
Sylgard® 309	NA	Fathead minnow >4.6 mg/L	22.9 to >41 mg/L (zero population growth con'c = 18 mg/L)	
Dyne-Amic®	NA	26.9 mg/L	NA	ST
Sticker/Spreaders				
Oils				
MSO®	NA	NA	NA	
Hasten®	74 mg/L	NA	>50 mg/L	Slightly toxic to trout
Blends of vegetable oils and silicone-based surfactants				
Syl-tac™	>5 mg/L	NA	>5 mg/L	MT-ST
Phase™	NA	NA	NA	

Currently, the state of Idaho does not have a registration system for adjuvants. In order to address toxicity concerns related to the use of adjuvants in riparian areas, SCNF proposes to use only Washington State aquatic-certified adjuvants in riparian areas. The state of Washington certifies adjuvants for aquatic use with its own state registration numbers. To be certified in Washington, adjuvant manufacturers have to provide a complete ingredient list, display all ingredients on the label and submit efficacy data to the state departments of water quality to prove that the product does what they claim it does. Once all requirements are met, the state assigns a unique state registration number that will be listed on the product label. A list of currently certified adjuvants is available at: State of Washington Department of Ecology: Pesticides Currently Allowed for Use in Washington State Waters.

Appendix E: Herbicide Application Guidelines Near Water

Table E-1: Herbicide Use in the SCNF based on Proximity to Water- Alternative 2

Active Ingredient	Distance to Open Water in Feet		
	< 15 feet	15-50 feet	> 50 feet
2, 4-D	X	X	X
chlorsulfuron		X	X
clopyralid		X	X
dicamba			X
glyphosate	X	X	X
imazapic		X	X
metsulfuron methyl		X	X
picloram			X
sulfometuron methyl		X	X
triclopyr triethylamine salt (TEA)		X	X

Table E-2: Herbicide Application Guidelines near Water- Alternatives 3, 4, and 5

Herbicide	Product	Use	Label Information with Respect to Water
2,4-D amine	Weedar 64	Riparian, Upland	Noted for aquatic use (Not being proposed by the SCNF for use in aquatic setting). Do not apply directly to water or areas where surface water is present or intertidal areas below the mean high water mark (except where noted).
Aminopyralid	Milestone	Riparian, Upland, Aerial	Do not apply directly to water or areas where surface water is present or intertidal areas below the mean high water mark. It is permissible to treat non-irrigation ditch banks, seasonal dry wetlands (such as flood plains, deltas, marshes, swamps, or bog) and transitional areas between upland and lowland sites. Milestone can be used to the water's edge. Do not apply directly to water and take precautions to minimize spray drift into water.
Chlorsulfuron	Telar XP	Riparian, Upland, Aerial	Do not apply directly to water or areas where surface water is present or intertidal areas below the mean high water mark. This product may be applied on forestry and non-agriculture sites that contain areas of temporary surface water caused by collection of water between planting bed, in equipment ruts, or in other depressions caused by management activities. It is permissible to treat intermittently flooded low lying sites, seasonal dry flood plains and traditional areas between upland and lowland sites when no water is present. It is also permissible to treat marshes, swamps and bogs after water has receded, as well as seasonally dry flood deltas. Do not make applications to natural or man-made bodies of water such as lakes, reservoirs, ponds, streams and canals.

Herbicide	Product	Use	Label Information with Respect to Water
Clopyralid	Transline	Riparian, Upland, Aerial	Do not apply directly to water or areas where surface water is present or intertidal areas below the mean high water mark.
Dicamba	Banvel	Upland	Do not apply directly to water or areas where surface water is present or intertidal areas below the mean high water mark. Do not apply within riparian area or 50 feet from water whichever is greater.
Glyphosate	Rodeo	Aquatic, Riparian, Upland, Aerial	May be used in and around water and wetlands. May be applied to emerged weeds in all bodies of fresh and brackish water which may be flowing, non-flowing or transient.
Imazamox	Clearcast	Aquatic, Riparian	The product is an aqueous formulation that may be diluted in water for control/suppression of certain submerged aquatic vegetation or applied as a broadcast or spot spray to floating and emergent vegetation. Do not apply to water except as specified in label.
Imazapic	Plateau	Upland, Riparian, Aerial	Do not apply directly to water or areas where surface water is present or intertidal areas below the mean high water mark. A level well maintained vegetative buffer strip between areas to which this product is applied and surface water features such as ponds, streams and springs will reduce the potential for contamination of water from rainfall-runoff. Runoff of this product will be reduced by avoiding applications which rainfall is forecasted to occur within 48 hours.
Imazapyr	Habitat	Aquatic, Riparian, Upland	Applications may only be made for the control of undesirable emergent and floating aquatic vegetation in and around standing and flowing water. To minimize hazards, do not treat more than one half of the water area in a single operation, and wait at least ten to fourteen days between treatment . Applications may be made to control undesirable wetland, riparian and terrestrial vegetation growing in or around surface water.

Herbicide	Product	Use	Label Information with Respect to Water
Metsulfuron-methyl	Escort XP	Riparian, Upland, Aerial	Do not apply directly to water or areas where surface water is present or intertidal areas below the mean high water mark. This product may be applied on forestry and non-agriculture sites that contain areas of temporary surface water caused by collection of water between planting beds, in equipment ruts, or in other depressions created by management activities. It is permissible to treat intermittently flooded low lying sites, seasonal dry flood plains and transitional areas between upland and lowland sites when no water is present. It is also permissible to treat marshes, swamps and bogs after water has receded, as well as seasonally dry flood deltas. Do not make applications to natural or man-made bodies of water such as lakes, reservoirs, ponds, streams and canals.
Picloram	Tordon 22K	Upland, Aerial	Do not apply directly to water or areas where surface water is present or intertidal areas below the mean high water mark. Do not apply within riparian area or 50 feet from water whichever is greater.
Sulfometuron-methyl	Oust XP	Riparian, Upland, Aerial	This product may be applied on forestry and non-agriculture sites that contain areas of temporary surface water caused by collection of water between planting beds, in equipment ruts, or in other depressions created by management activities. It is permissible to treat intermittently flooded low lying sites, seasonal dry flood plains and transitional areas between upland and lowland sites when no water is present. It is also permissible to treat marshes, swamps and bogs after water has receded, as well as seasonally dry flood deltas. Do not make applications to natural or man-made bodies of water such as lakes, reservoirs, ponds, streams and canals. Ground: When applying liquid sprays the following directional buffers are required to protect aquatic vegetation in sites (including lakes, reservoirs, rivers, streams, marshes, ponds, estuaries, commercial fish ponds) or water used as an irrigation source, or crops: All broadcast applications other than railroad and roadside rights of way – 50 feet; Railroad and roadside rights of way – 25 feet; All handheld spot treatment applications – 15 feet.

Herbicide	Product	Use	Label Information with Respect to Water
Triclopyr	Garlon 3A	Aquatic, Riparian, Upland	May be used within forest and non-crop sites to control target vegetation in and around standing water sites. To minimize hazards, do not treat more than one-third to one-half of the water area in a single operation, and wait at least ten to fourteen days between treatments.

Appendix F: Aerial Herbicide Application Coordination and Safety Implementation Plan

SCNF would implement an aerial herbicide application using the following general procedures and utilize the Aerial Herbicide Application Checklist (Table F-1) to document appropriate steps regarding coordination, safety, and implementation that would be taken.

Make initial notifications to all relevant program managers

- SCNF weed managers would notify the Forest Supervisor, District Ranger, and other program managers such as watershed, recreation, range, fisheries, and wildlife of the upcoming application. County Weed and BLM program managers would also be notified.

Coordinate with applicable resource specialists to define suitable treatments

- Consider site specific factors such as watershed drainage areas, streamflow, topography, and soil type when defining the location of aerial treatments, the size of treatment areas, and specific herbicides to be used.
- Identify specific avoidance areas related to riparian buffers, wildlife considerations, and human uses.

Organize resources (personnel, equipment, funds)

- SCNF would determine and organize the resources needed to conduct inventories for weed and sensitive plants in the proposed treatment unit(s), establish a communications system and implement monitoring.
- Solicit proposals from qualified contractors for the aerial application and award contract.

Establish external communications system

- Inform nearby landowners and forest permittees of the application and tentative dates.
- SCNF would announce the aerial application at least two weeks prior to the tentative application dates to inform the general public. A variety of communication tools could be used including e-mail, phone calls, letters, websites, radio, newspaper, etc.

Launch control actions

- Inventory weed infestations in treatment unit for up-to-date information on weed cover and distribution.
- Inventory treatment unit for the presence of sensitive plant species.
- GPS excluded areas (e.g. seeps, sensitive plant populations)
- Install drift detection monitoring along perennial and intermittent streams within or near (within 300 feet) the treatment units.
- Monitor weather forecasts prior to the application and obtain spot weather forecasts using portable weather kits, as needed
- Adjust date and time of application

- Implement aerial application

Institute monitoring

- The site would be monitored on a regular basis to determine treatment efficacy, need for follow-up treatments and to document non-target effects.

Evaluate the response

- SCNF would conduct an After Action Review to determine how well procedures for implementing aerial application worked. The review would assess strengths of the response, weaknesses and means of improving the process for future applications.

Table F-1: Aerial Herbicide Application Checklist

Date Accomplished	Item to Accomplish
Coordination	
	Brief District Ranger and Forest Supervisor
	Coordinate with Forest and/or District Fisheries Biologists and Forest Hydrologist
	Review design criteria
	Consider site-specific factors to define application area and herbicides used
	Identify riparian area buffers
	Coordinate with Forest and/or District Wildlife Biologist
	Identify wildlife considerations such as raptor nests, pygmy rabbit burrow complex locations, etc.
	Coordinate with District Rangeland Management Specialist
	Notify affected livestock permittees
	Coordinate with Forest Botanist or proxy
	Assess need for and conduct sensitive plant population surveys
	Notify Forest Aviation Officer
	Notify regulatory agencies (NMFS, USFWS)
	Notify County and BLM weed management personnel
	Notify area landowners
	Notify general public
	Release details of any area closures during helicopter operations
Safety	
	Complete a project-specific aviation safety plan
	Notify Central Idaho Dispatch
	Have Forest Aviation Officer approve staging areas and landing zones
	Have Forest Supervisor issue temporary closure order for treatment area if necessary
	Post treatment area
	Conduct job hazard analysis
	Have evacuation plan in place in case of medical emergency
	Review of herbicide and adjuvant labels and Material Safety Data Sheets
	Review SCNF Spill Response Plan and necessary spill response materials
	Conduct pre-implementation safety meeting
Implementation and Operations	
	Conduct inventory of infestations scheduled for aerial application
	Complete project-specific Implementation and Operations Plan

Date Accomplished	Item to Accomplish
	Have weed program managers meet with contractor pilot and helicopter manager to review contract and operational details (flight paths, unit boundaries, excluded areas {riparian buffers, sensitive plant populations}, staging area, flight following, herbicides and adjuvants, drift control, nozzle size, application rate, radio communication between pilot and ground crews, etc.)
	Obtain weather forecast and conduct on-site weather monitoring, if needed
	Conduct project personnel briefings
	Conduct implementation of aerial application
	Monitor for drift detection
	Review pre- and post-treatment monitoring results

Appendix G: Aerial Herbicide Drift Monitoring Procedure

During aerial herbicide applications, it is important to keep herbicide from reaching live water to protect aquatic resources and water quality. This is accomplished through the use of 300 feet "no treatment" buffer zones along streams and other water bodies. The purpose of drift monitoring during aerial herbicide applications is to detect drift that may be occurring and to prevent drift from reaching live water. Data from the Bitterroot National Forest indicates that a 300-foot buffer is more than sufficient to prevent drift from aerially applied herbicide from reaching water bodies (Kulla 2002). Monitoring for drift inside these "no treatment' buffer zone is conducted using drift detection cards. Drift detection cards are made of specially coated paper that record contact with water by turning blue where water makes contact with the coated surface. These cards are very sensitive to moisture (even to high levels of humidity or sweat on fingers and palms of hands) and must be handled very carefully.

Monitoring Procedure

To monitor for drift within the "no treatment" buffers along streams, drift detection cards will be placed perpendicular and downslope from the waterbody, within the treatment units, as needed and appropriate. Where a treatment unit is bisected by a stream, drift detection cards may be placed on both sides of the stream depending on buffer distances and wind direction and speed.

For other live water bodies, drift detection cards will be placed at intervals moving outwards from the water body where it intersects the treatment area. The line farthest from the water body will initially be located at 300 feet, in appropriate locations where drift could potentially occur.

Before the day's application, project managers will determine strategic locations for placing drift detection cards. GPS coordinates will be taken and an individual identification number recorded at the site of each card holder. Project personnel will observe and record information on dew and precipitation on vegetation from the night before. Care is required in setting out the cards as they are very sensitive to moisture and contact by dew drops can skew monitoring results.

Buffer distances from live water will be specifically identified on all treatment area maps and provided to the pilot both digitally and hard copy so pilot can visually reference the buffers. Drift detection cards will be used to determine if desired coverage is being attained. Application can be adjusted as necessary based on feedback from these drift cards.

The pattern on drift detection cards in subsequent intervals, placed as needed where drift has the potential to occur, will be monitored during application to detect drift. Wind speed and wind direction would continue to be closely monitored.

Observations by personnel at the time of collection are critical to an accurate reading. To complete and document monitoring, project personnel will observe and record spray detection on the cards before removing them from the card holders. Each drift detection card will be photographed and tagged for identification. Cards will be handled carefully along the edges only to avoid damage to the record. Dew markings, animal tracks, herbicide and other markings will be recorded. Each card will be sealed in a dry sealed plastic bag for transport and storage.

Complete the drift detection monitoring cards results form and attach observation report and photos.

(PROJECT NAME) Drift Detection Monitoring Card Results

Date:

Observer:

Distance from Water Body	Name of Water Body –	Name of Water Body –	Name of Water Body –	Comments
50’				
100’				
150’				
200’				
250’				
300’				

ND = No Detection (i.e. drops are NOT present on the card)

D = Detection (i.e. drops are present on the card)

U = Uniform Herbicide Application Pattern

For each drift detection card interval, record the following:

- Water droplets accumulated before application (dew drops, etc.)
- No detection of herbicide drops (code as ND on the form)
- Detection of herbicide drops (Code as D on the form followed by percent of the card containing drops)
- Other: rodent tracks, damage to card by wildlife, etc.
- Comments

Determination of Percentage

Percent will be determined by dividing a drift detection card into 20 equal-sized squares. Each square represents 5% of the area of a single drift detection card. For example, if three squares were found to contain herbicide, this would correspond to 15% of the drift detection card area.

If herbicide is detected on a drift detection card, the recorder will determine by percent, what portion of the card illustrates that drift is occurring to communicate to project managers and pilot.

Appendix H: Past, Current, and Foreseeable Future Activities in the Salmon-Challis National Forest

Past Activities

Cumulative effects are "*the incremental impacts of the proposed action and alternatives when added to effects of other actions both on National Forest System lands and other adjacent federal, state, or private lands"* (40 Code of Federal Regulations (CFR) 1508.7).

The Council on Environmental Quality (CEQ) regulations do not require the consideration of the individual effects of all past actions to determine the present effects of past actions. In regard to past actions, the agency must determine what information regarding past actions is useful and relevant to the required analysis of cumulative effects during the scoping process and the preparation of the analysis. Dependent upon the proposed action, the accounting for past actions and specific information about the direct and indirect effects of their design and implementation could, in some contexts, be useful to predict the cumulative effects of the proposal. The CEQ regulations, however, do not require agencies to comprehensively list and analyze all individual past actions. Just because information about past actions may be available or obtained with reasonable effort does not mean that it is relevant and necessary to inform decision making (40 CFR 1508.7).

Human activities are known to have influenced the spread of invasive plants into North America, the Pacific Northwest and specific sites within the project area. A complete list of past actions is not necessary to understand how land uses have contributed to the current distribution of invasive plants. The baseline for cumulative effects analysis is the current condition.

A list of ongoing activities and foreseeable future projects are available in Table H-2, below. Many of these activities have the potential to introduce or spread noxious invasive plants. Permitted activities have stipulations, such as prevention measures included in grazing allotment annual operating instructions, timber sale contracts, and mineral material plans of operation. The recent update of the SCNF travel management plan eliminated cross country motorized travel, which eliminated a substantial potential for introducing or spreading noxious invasive species. The acres of wildfire illustrate the disturbed acres that have the potential for noxious plant invasion. Although the possibility for the increase of infestations (i.e. wildfire) as well as for the decrease (i.e. elimination of cross country motorized travel) exists for virtually any activity that occurs on the SCNF, the maximum number of acres that would be treated- which are identified in the alternatives- would not change based upon these activities.

Ongoing Non-Forest Chemical Treatments

Because of the manner in which the State of Idaho collects data regarding pesticide use, it is not possible to track which herbicides are used or in what quantity on private land. However, CWMA partners do track that information. Table H-1 displays the three year average of applied acres of herbicide in Butte, Custer, and Lemhi Counties, as well as the herbicide use on the Salmon-Challis portion of the Frank Church-River of No Return Wilderness Area (FC-RONR). The County CWMAs treat private, state, county and federally-owned lands and provide herbicide to land owners. The numbers below display the acres of herbicide that were applied by the County

CWMAs, not acres that were applied by private land owners. CWMA partners are licensed pesticide applicators, therefore herbicides were applied in compliance with label direction.

Table H-1: Three Year (2010-2012) Average of Applied Herbicide Acres

Active Ingredient	Butte County	Custer County	Challis BLM	Lemhi County-Private	Lemhi County-BLM	FC-RONR	Total
2,4-D Amine	730.9	490.3	1.9	569.5	158.2	2.5	1953.4
2,4-D Ester	13.1	16.0					29.1
Aminopyralid	493.0	271.0		73.3		51.5	888.7
Aminopyralid + 2,4-D		3.0				8.4	11.4
Aminopyralid + metsulfuron						4.0	4.0
Aminocyclopyrachlor	16.6	165.0		7.4			189.0
Bromacil + Diuron		48.4					48.4
Chlorsulfuron	9.6	21.4	1.5	88.9	13.5	9.8	144.6
chlorsulfuron + 2,4-D			2.0				2.0
Clopyralid	16.9	2.3		10.5	82.1	5.6	117.4
clopyralid + 2,4-D			2.6				2.6
Dicamba + 2,4-D + Fluroxypyr		16.6					16.6
Diglycolamine				13.1			13.1
Diuron				102.6			102.6
Flumioxazin	11.7			3.5			15.2
Glyphosate	60.8	44.6	1.1	41.5	18.6	2.0	
glyphosate (with POAE)							0
Imazapic	284.8	38.8		8.7	58.3	4.6	395.3
Imazapyr	35.3			8.6			43.9
Indaziflam				2.9			2.9
Isoxaben		0.1					0.1
metsulfuron methyl	82.4			1.6		29.6	113.6
metsulfuron methyl + 2,4-D			2.5				2.5
Picloram	287.1	123.1	0.5	43.9	96.0	0.0	550.7
Picloram + 2,4-D			67.7				67.7
Sulfentrazone				3.8			3.8
Sulfometuron methyl		3.2		2.6			5.8
Triclopyr	13.1	8.8	1.2	15.8			38.8
Topramezone				0.9			0.9
Water Conditioning Agent		11.5					11.5
Total	**2,015.9**	**1,123.0**	**76.5**	**900.3**	**426.7**	**103.1**	**4645.6**

Current and Foreseeable Future Activities

Table H-2: Current and Foreseeable Future Activities

Current Activities	Acres	Miles	Notes
TIMBER			
Pahsimeroi -Lost Zone			
Lost River RD			
White Knob	41		
Salmon Zone			
Salmon-Cobalt RD			
Missouri	87		
Ludwig	140		
Upper Salmon Zone			
Challis-Yankee Fork RD			
Buster Lake Road Timber Sale	15		
PICO Fuelwood Timber Sale	122		
Custer Motorway Decks	15		
Bonanza Commercial Fuelwood and Forest Products	70		
Middle Fork RD			
Capehorn Ranch Timber Sale	232		
Banner Fire Timber Sale	60		
Dry Creek Roadside HTR Timber Sale	205		
Marsh Creek Roadside HTR Timber Sale	11		
Boy Scout Hill Timber Sale	62		
Lo-elly Timber Sale	180		
Valley Creek Decks	5		
Camp Bradley Timber Sale	182		
203-199 Roadside HTR	68		
172 Roadside HTR	48		
008 Roadside HTR	72		
RANGE			For a complete list of allotments, see the Range Specialist Report
Lemhi Zone	303,820		
North Zone	137,519		
Pahsimeroi-Lost Zone	934,784		
Salmon Zone	509,614		
Upper Salmon Zone	481,902		
Grand Total	2,367,639		
TRAVEL MANANGEMENT			
Cross Country Travel			
Lemhi Zone	0		
North Zone	0		
Pahsimeroi-Lost Zone	0		
Salmon Zone	0		
Upper Salmon Zone	0		
Grand Total	0		

Current Activities	Acres	Miles	Notes
Motorized Trails			
Lemhi Zone		127	
North Zone		103	
Pahsimeroi-Lost Zone		209	
Salmon Zone		130	
Upper Salmon Zone		280	
Grand Total		848	
Motorized roads			
Lemhi Zone		211	
North Zone		436	
Pahsimeroi-Lost Zone		603	
Salmon Zone		751	
Upper Salmon Zone		635	
Grand Total		2,636	
Non-motorized trails			
Lemhi Zone		80	
North Zone		143	
Pahsimeroi-Lost Zone		203	
Salmon Zone		249	
Upper Salmon Zone		137	
Grand Total		812	
MINERALS			
North Zone			
North Fork RD			
Votler Minerals Material Pit	3		
Pahsimeroi-Lost Zone			
Lost River RD			
Prudent Man Mining	2		
Salmon Zone			
Salmon-Cobalt RD			
Blackbird Mine Remediation	50		
Idaho Cobalt Project Site Reclamation	200		
Twelvemile Minerals Material Pit	3		
Squaw Creek Mineral Material Pit	2		
Perreau Minerals Material Pit	2		
Wallace Creek Mineral Material Pit	2		
Upper Salmon Zone			
Challis-Yankee Fork RD			
Thompson Creek Mine	150		
Thompson Creek Exploration Drilling	4		
Bruno Creek Exploration Drilling	3		
Middle Fork RD			
Blind Summit Mineral Material Site	5		
FIRE HISTORY (1999-2013)	**Acres Burned**		**Percent of Weed Zone Burned**
Lemhi Zone	13,515		4%
North Zone	241,452		58%

Current Activities	Acres	Miles	Notes
Pahsimeroi-Lost Zone	14,390		1%
Salmon Zone	176,145		27%
Upper Salmon Zone	183,163		28%
Grand Total	628,665		20%
Foreseeable Future Activities	**Acres**	**Miles**	**Notes**
VEGETATION MANAGEMENT			
FUELS			
Pahsimeroi-Lost Zone			
Lost River RD			
Sawmill Canyon Vegetation Management Project	450		
Sawmill Aspen Treatment	198		
Upper Salmon Zone			
Challis-Yankee Fork RD			
Upper Yankee Fork Fuels Reduction Project	8,269		
Mosquito Flat Fuels Reduction Project	9,700		
TIMBER			
North Zone			
North Fork RD			
Upper North Fork HFRA Ecosystem Restoration Project	41,000		
Salmon Zone			
Salmon-Cobalt RD			
Cougar-Phelan Salvage Project	250		
Deep Creek Ridge Salvage Project	250		
Upper Salmon Zone			
Challis-Yankee Fork RD			
West Fork Morgan Creek Vegetation Management Project	3,200		
MINERALS			
Lemhi Zone			
Leadore RD			
Flume Creek Exploration Drilling	<0.1		
North Zone			
North Fork RD			
Clementine Placer	0.1		
East Boulder Creek Placer Proposal	<0.1		
North Fork Sheep Creek Exploration Trenching Proposal	<0.1		
Pahsimeroi-Lost Zone			
Lost River RD			
Great Western Exploration Drilling	1		
Salmon Zone			
Salmon-Cobalt RD			
Gold Star Exploration Drilling Project		1.3	

Current Activities	Acres	Miles	Notes
Inception Resources Company, Road Construction Proposal		0.5	
Iron Creek Exploration Project	0.2		
Rapps Creek Placer Proposal	<0.1		
Upper Salmon Zone			
Challis-Yankee Fork RD			
Thompson Creek Modified Plan of Operation	150		
RANGE			
Lemhi Zone			
Leadore RD			
Fish Pasture Fence and Spring Development		0.3	
Payne Creek Springs Development		TBD	
Soapstone Springs Exclosure Expansion		50	
Pahsimeroi-Lost Zone			
Lost River RD			
Bell Mountain Allotment, Deep Creek Spring Pipeline		0.3	
Lost River Small Batch Fences		1.3	
Warm Creek Habitat Improvement Fence		0.3	
RECREATION			
Issue New Upland O&G Permits with Hunting Camps			
Lemhi Zone			
Leadore- 1 permit	< 0.5		
North Zone			
North Fork- 2 permits	< 1 acre		
Upper Salmon Zone			
Challis-Yankee Fork- 3 permits	< 1.5		
Issue New Permits for Expired Outfitter and Guide Permits			
North Zone			
North Fork RD -1	N/A		
Pahsimeroi-Lost Zone			
Lost River RD -1	N/A		
Salmon Zone			
Salmon Cobalt -1	N/A		
Upper Salmon Zone			
Challis Yankee Fork RD - 2	N/A		
Middle Fork RD - 6	N/A		
TRAVEL MANAGEMENT			
Pahsimeroi-Lost Zone			
Ballpark Road Re-location		0.3	

Appendix I: Common Injuries to Non-Target Species by Herbicide Active Ingredients

Table I-1: Common Injuries to Non-Target Species by Herbicide Active Ingredients for Terrestrial Use

Herbicide Active Ingredient	Comments	Conifers	Deciduous Trees/Shrubs	Evergreen Shrubs (sagebrush, mahogany, bitterbrush, etc.)	Grasses	Forbs
2,4-D	Selective herbicide, very limited soil residual activity. Primarily under canopy applications.	Seedlings susceptible to injury (e.g. slowed growth, leader dieback), but conifers otherwise tolerant of rates used on forbs, injury includes chlorosis (leaves produce insufficient chlorophyll) and needle-shed of damaged foliage. More tolerant than deciduous species.	Seedlings may be injured or killed. Tolerant of rates used on forbs, injury includes leaf curling/ cupping, twisting, defoliation of damaged foliage. High application rates could result in root absorption and increased injury.	Seedlings may be injured or killed. Many species tolerant of rates used on forbs, injury includes leaf curling/ cupping, twisting, chlorosis, defoliation of damaged foliage.	Tolerant after the seedling stage. Reduced seed production if high rates applied during flower to seed-producing stages.	Most families susceptible to some degree. Active plants will tolerate some injury at low rates. No injury to dormant plants from fall applications.
Aminopyralid	Selective herbicide. Soil residual activity. Under and over canopy applications	Mortality of seedlings. If applied within the dripline, root-uptake and injury possible. Injury from application to foliage includes chlorosis, possible needle-shed and branch dieback.	Mortality/severe injury of seedlings/saplings. Deciduous species more tolerant than conifers. Typical injury is minor (leaf curling/cupping).	Possible mortality/severe injury of seedlings. Otherwise, many shrub species tolerant. Temporary injury is minor (leaf curling/cupping).	Grasses tolerant after the seedling stage. Injury/death to seedlings, increased if tank-mixed with 2, 4-D. No injury after 45 days post-germination	Most native forb families moderately tolerant to tolerant.

Herbicide Active Ingredient	Comments	Conifers	Deciduous Trees/Shrubs	Evergreen Shrubs (sagebrush, mahogany, bitterbrush, etc.)	Grasses	Forbs
Chlorsulfuron	Selective herbicide. Slight soil residual activity. Primarily under canopy applications.	Tolerant at typical use rates. Injury (e.g. needle curl/ chlorosis) may result if applied during active foliage growth.	Seedlings may be injured or killed. Otherwise, tolerant at typical use rates for forbs. Some leaf curl/ chlorosis possible if applied during active foliage growth.	Seedlings may be injured or killed. Many species tolerant of rates used on forbs. Some leaf curl/ chlorosis possible if applied during active foliage growth.	Tolerant at low use rates. Foliage and seed production could be reduced.	Borage, mustard, and pea families most susceptible. Many plants in the aster family tolerant at typical use rates.
Clopyralid	Narrow spectrum, selective herbicide. Short-term residual activity. Under and over canopy applications.D2	Tolerant at typical use rates. Injury (e.g. needle curl/ chlorosis) may result if applied during active foliage growth.	Tolerant of rates used on forbs. Some leaf curl possible if applied during active foliage growth.	Evergreen species tolerant of rates used on forbs. Some leaf curl possible if applied during active foliage growth.	Tolerant after the seedling stage.	Four families primarily susceptible: aster, pea, knotweed, and nightshade. Borage family tolerant. Many families, (e.g. mustard, pink, goosefoot, morning glory) not susceptible. Corm/bulb species not susceptible.

Herbicide Active Ingredient	Comments	Conifers	Deciduous Trees/Shrubs	Evergreen Shrubs (sagebrush, mahogany, bitterbrush, etc.)	Grasses	Forbs
Dicamba	Selective herbicide. Some soil residual activity, primarily during growing season in which applied. Primarily under canopy applications.	If applied within the dripline, root-uptake and injury possible. Application to foliage includes chlorosis, possible needle-shed and branch dieback. More tolerant than deciduous species.	Seedlings may be injured or killed. If applied within the dripline, root-uptake and injury possible. Injury from foliar application includes cupping, curling, epinasty and possible defoliation and branch dieback.	Seedlings may be injured or killed. Injury from foliar application includes cupping, curling, epinasty (increased growth on upper surface of leaf) and possible defoliation and branch dieback. Root-sprouting species recover quickly. Mahogany and bitterbrush more susceptible.	Tolerant after the seedling stage.	Most families susceptible to some degree, pea family especially susceptible.
Glyphosate	Non-selective, no soil residual. Primarily under canopy applications.	Little to no root uptake. Injury/ death of living tissue (foliage, green stems, non-woody tissue) where sprayed. Otherwise no injury.	Little to no root uptake. Injury/ death of living tissue (foliage, green stems, non-woody tissue) where sprayed. Otherwise no injury.	Injury/death of living tissue (foliage, green stems, non-woody tissue) where sprayed. Otherwise no injury.	Established perennial grass stands tolerant at low use rates, even when mixed with 2,4-D, although foliage and seed production is reduced.	Most families susceptible. Active plants will tolerate some injury at low rates. No injury if dormant.

Herbicide Active Ingredient	Comments	Conifers	Deciduous Trees/Shrubs	Evergreen Shrubs (sagebrush, mahogany, bitterbrush, etc.)	Grasses	Forbs
Imazamox	Active on submerged, emergent and floating broadleaf and monocot species.			**Algae**- Varies from no adverse effects to slight to moderate growth inhibition. Little information available overall.	Active on submerged, emergent and floating broadleaf and monocot species.	**Macrophytes**- Will damage many native macrophytic species. Effects include reduced root and shoot growth, curling, chlorosis and/or necrosis and plant death.
Imazapic	Selective herbicide, often used in restoration projects. Some soil residual activity at higher rates. Under and over canopy applications.	Most species very tolerant of over and under canopy applications up to maximum label rate.	Some minor injury may result (e.g. tip chlorosis, minor death of plant tissue).	Most species very tolerant of over and under canopy applications up to maximum label rate.	Many perennial grasses tolerant to very tolerant, application and reseeding of these perennial grasses can take place at the same time. Some perennials and annual grasses more susceptible.	Many families tolerant to very tolerant. Borage, mustard, and goosefoot susceptible. Aster family not susceptible.
Imazapyr	Non-selective herbicide. Slow-acting. Soil residual activity. Over and under canopy applications. Effective control on woody species.	Woody species susceptible. Apply well outside the dripline of nontarget species.	Woody species susceptible. Apply well outside the dripline of nontarget species.	Woody species susceptible. Apply well outside the dripline of nontarget species.	Many grasses susceptible. Used to control cheatgrass, for example.	Most families susceptible.

Herbicide Active Ingredient	Comments	Conifers	Deciduous Trees/Shrubs	Evergreen Shrubs (sagebrush, mahogany, bitterbrush, etc.)	Grasses	Forbs
Metsulfuron methyl	Non-selective herbicide, primarily used by SCNF on annual grasses. Slight soil residual activity. Primarily under canopy applications.	Tolerant at typical use rates. Injury (e.g. needle curl/ chlorosis) possible.	Seedlings may be injured or killed. Otherwise, tolerant at typical use rates. Injury (e.g. chlorosis) is temporary.	Tolerant, although small seedlings may be injured or killed. Some leaf curl/ chlorosis possible.	Used to control annual grasses. Established stands of perennial native grasses not affected past the seedling stage.	Most families not susceptible at rates used on invasive annual grasses (up to 1.5 oz/ac). Slight, temporary injury may occur.
Picloram	Selective herbicide. Soil residual activity up to one year after application. Under canopy applications.	If applied within the dripline, root-uptake and injury possible. Application to foliage includes chlorosis, possible needle-shed and branch dieback.	Seedlings may be injured or killed. If applied within the dripline, root-uptake and injury possible. Injury from foliar application includes cupping, curling, epinasty and possible defoliation and branch dieback. Cottonwoods/willows more susceptible.	Seedlings may be injured or killed. Many species are susceptible during active growth, especially when tank-mixed (e.g. with 2,4-D). Sagebrush less susceptible at lower (16 - 24 oz/ac) rates used for forbs. Root-sprouting species recover quickly. Mahogany and bitterbrush very susceptible.	Tolerant after the seedling stage at rates up to 32 oz/ac. Temporary injury including inhibited growth, chlorosis at higher rates.	Many families susceptible to some degree, injury/mortality particularly for aster and pea. Established, deep-rooted plants less so than young or shallow-rooted plants. Corm/bulb species not as susceptible as fibrous-rooted species, will tolerate lower rates with temporary injury (inhibited flowering, leaf damage, etc.)

Herbicide Active Ingredient	Comments	Conifers	Deciduous Trees/Shrubs	Evergreen Shrubs (sagebrush, mahogany, bitterbrush, etc.)	Grasses	Forbs
Sulfometuron methyl	Selective herbicide. Slight soil residual activity. Primarily under canopy applications.	Tolerant at typical use rates. Injury (e.g. needle curl/ chlorosis) possible.	Injury or death at rates above 1 oz/ac, particularly when tank-mixed.	Injury or death at rates above 1 oz/ac, particularly when tank-mixed.	Severe injury to seedlings. Used in establishment of native perennial grasses, which are tolerant once established. Foliage and seed production could be reduced.	Borage, mustard, and pea most susceptible. Many plants in the aster family tolerant at typical use rates.
Triclopyr	Selective herbicide. Soil residual activity during the growing season in which applied. Primarily under canopy applications.	Tolerant at typical use rates. Injury (e.g. needle curl/ chlorosis) may result if applied at high rates.	Many species susceptible, but somewhat tolerant of rates used on forbs. Injury to sprayed foliage including leaf curl, death of plant tissue, defoliation, and branch dieback. Higher rates will cause mortality.	Many species susceptible, but somewhat tolerant of rates used on forbs. Injury includes chlorosis, death of plant tissue, defoliation, branch dieback, etc. Higher rates will cause mortality.	Tolerant after the seedling stage.	Borage, mustard, and peas families most susceptible. Many plants in the aster family tolerant at typical use rates.

Season of use for all herbicides is spring through fall

Table I-2. Common Injuries to Non-Target Species by Herbicide Active Ingredients for Aquatic Use

Herbicide Active Ingredient	Comments	Algal Species	Graminoids	Macrophytes
Glyphosate	Non-selective herbicide for many broadleaf and monocot species. Readily moved to above ground and below ground plant parts. Active ONLY on floating and emergent vegetation. Does not kill submersed vegetation.	Varies from stimulation of growth (apparently beneficial) to no adverse effects to slight to moderate growth inhibition and injury.	Rate dependent, but may damage or kill wetland grass species. Chlorosis and death of affected tissue. May injure or kill root system depending on species and rate used. Damage on tolerant species is usually temporary.	Glyphosate will damage or kill many native emergent or floating species (e.g. cattails). Effects include wilting, chlorosis, death of plant tissue, and plant death.
Imazamox	Active on submerged, emergent and floating broadleaf and monocot species.	Varies from no adverse effects to slight to moderate growth inhibition. Little information available overall.	Varies from no effect to severe effects. Reduced root and shoot growth. Curling, chlorosis and/or death of plant tissue at stem tips at moderate to high use rates.	Imazamox will damage many native macrophytic species. Effects include reduced root and shoot growth, curling, chlorosis and/or death of plant tissue and plant death.
Imazapyr	Non-selective herbicide for many broadleaf and monocot species. Readily translocated to above ground and below ground plant parts. Active ONLY on floating and emergent vegetation. Does not kill submersed vegetation.	May cause short-term damage to some sensitive species of algae. However, imazapyr is not an effective algaecide and adverse effects from aquatic applications would not be anticipated.	Rate dependent, but may damage or kill some wetland graminoid species. Chlorosis and death of plant tissue of affected tissue. May injure or kill root system depending on species and rate used. Damage on tolerant species is usually temporary. Damage from indirect exposure (e.g. shoreline plants with roots extending into a treated body of water) is not likely.	Imazapyr will damage many native emergent or floating macrophytic species. Effects include reduced root and shoot growth, chlorosis, death of plant tissue and plant death. Sensitive species are likely to be killed. Damage from indirect exposure (e.g. shoreline plants with roots extending into a treated body of water) is less likely.
Triclopyr	Selective herbicide on broadleaf plants. Active on submersed, emergent and floating plants.	Triclopyr triethylamine salt (TEA) is much less toxic than Triclopyr BEE. Triclopyr TEA may cause short-term damage to some sensitive species of algae. Filamentous or rod-shaped algae may be somewhat more sensitive to triclopyr TEA than spherically-shaped algal species. Long-term adverse effects to algae would not be anticipated.	Triclopyr TEA controls woody species and broadleaf species. Grasses are not susceptible. Damage to a sensitive species would be temporary.	Triclopyr will damage many native macrophytic species with effects lasting a year or more. Effects include reduced root and shoot growth, chlorosis, death of plant tissue and plant death. Plants of sensitive species are likely to be killed.

Appendix J: Design Criteria for All Action Alternatives

Alternative 2- Current Action

Biological Control

- Obtain Animal and Plant Health Inspection Service (APHIS) permit to Move Live Plant Pests, Noxious Weeds, or Soil for those agents when transportation across state lines is involved.
- There would be no intentional releases of unapproved biological control agents.
- There would be no intentional releases of agents known to feed on species other than those that were introduced to control specified invasive plant species.
- Use appropriate Forest Service protocols for documentation of releases and monitoring and share release information with the Idaho State Department of Agriculture.
- Where possible, collect biological control agents locally or from areas with similar climatic and weather conditions, land and soil types, and cover types to maximize successful establishment to the extent practicable.
- Distribute biological control agents at the optimal season and life cycle stage to optimize the likelihood of successful establishment. Distribute quantities sufficient to optimize successful short-term establishment.
- For those agents that self-disperse poorly, actively assist the distribution throughout target infestations by redistribution (collecting and moving the agent to new locations).

Herbicide Application

- Herbicide application shall comply with applicable laws (Idaho Statute Title 22, Chapter 34 and Idaho Administrative Code Rule 02.03.03), Forest Service policy and guidelines (FSH 2109 and FSM 2150) and with product label directions for the herbicide being used to assure worker safety and to manage potential impacts of herbicide application.
- Always read and follow label directions, including instructions for herbicide use, application rates, equipment and techniques and personal protective equipment for applicators.
- See Appendix E regarding application of herbicides in proximity to water.
- Prior to implementation, program managers would ensure proper permitting is in place including National Pollutant Discharge Elimination System (NPDES) permits.
- Make sure Material Safety and Data Sheets, safety plans, spill prevention plans and cleanup kits are available to applicators, per the requirements of FSH 2109.
- Keep accurate and detailed application records, per Idaho Department of Agriculture Rules Governing Pesticide and Chemigation Use and Application (Idaho Statute Title 22, Chapter 34 and Idaho Administrative Code Rule 02.03.03).
- Perform herbicide applications by or under the direct supervision of licensed Idaho professional herbicide applicators for forest and contract crews, per Idaho Department of Agriculture Rules Governing Pesticide Use and Application.

- Ensure that contracts and agreements include appropriate prescriptions and that herbicides and application rates meet label requirements and site specific design criteria.
- Monitor wind speed and direction and equipment and spray parameters throughout an herbicide application. No herbicide shall be applied in sustained wind conditions exceeding five (5) miles per hour in riparian areas or in any wind conditions exceeding product label directions.
- Conduct equipment and personnel inspections and calibration as needed to ensure proper herbicide application and to meet regulatory requirements. Regularly check equipment and components for wear. Attend to repairs and parts replacement promptly.
- Transport only the quantity of herbicide and adjuvants needed for a project. Secure containers being transported in such a way to prevent the likelihood of spills. Make periodic checks en route to help avoid spillage. Carry herbicides and adjuvants in water-tight, floatable containers when supplies need to be carried over water by boat, raft, or other watercraft.
- When out in the field, restrict access to herbicides and adjuvants and spray equipment by unauthorized personnel to the extent possible.
- OHVs used to transport or spray herbicides are administratively allowed to travel off designated motorized routes. These vehicles would not be taken off designated routes if damage to soils could occur due to wet conditions. Take care to ensure that disturbance to desirable vegetation is minimized and that no visible “trail” creation occurs.
- Follow the procedures in the SCNF Spill Plan in the event of a spill (Appendix B).
- Use indicator dye in the herbicide mix to visually assure uniform coverage, minimize overlapped or skipped areas, and prevent non-target applications. Indicator dyes will be water-soluble and non-toxic.
- Within areas of special concern, such as developed recreation sites, trailheads, campsites and other high human areas, utilize treatments methods that minimize potential exposure to the public.
- To minimize herbicide drift during broadcast operations, use low pressure and larger droplet size to the extent possible with the equipment being used. Use nozzles designed for herbicide application.
- Equip water drafting equipment with back siphoning prevention devices.
- Wherever possible, mix and load at a distance greater than 100 feet from water and where spilled materials will not flow into groundwater, wetlands, or streams.
- Provide herbicide "awareness" information to forest users as opportunities arise. Treatment areas will be signed prior to herbicide applications within areas of special concern, such as trailheads, campsites, and other high use areas. Make information on where and when spraying and other treatments would occur available to the public at the local Ranger District office. Forest Service and other websites may also be used for public notification.
- Follow label directions and other information sources to apply herbicides to the target species during phenological stages that optimize target control.
- To the extent practicable, apply herbicides to infestations containing biological control agents at times when the effects of herbicides to the host plants would not interfere with the agent’s life cycle.

- Avoid non-target damage to the extent practicable. Native or desired plant species may compete well with the target invasive plant species once its density has been reduced and help in recovery of the site through natural means.

Sensitive Plant Species

- Provide training on SCNF sensitive plant identification and key habitat characteristics to help field crews correctly identify, survey, and map Sensitive plants and successfully implement invasive plant control treatments in sensitive plant populations.
- Evaluate sites considered for herbicide treatment for sensitive plant habitat suitability. Survey suitable habitat as necessary prior to treatment. The need for field surveys in suitable habitat is based on factors such as plant phenology at the time of treatment and species' susceptibility to the herbicide(s) being used.
- Mechanical treatment, individual plant treatment, or spot herbicide applications are preferred methods when treating invasive plant infestations within or directly adjacent to sensitive plant populations.
- To minimize herbicide drift, suspend herbicide applications in or directly adjacent to sensitive plant populations when sustained wind speeds exceed 5 miles per hour. Conduct post-treatment monitoring in known sensitive plant populations to determine efficacy of the invasive plant control treatment and to detect unacceptable non-target impacts. This provides feedback that helps improve future herbicide control efforts.

Manual and Mechanical Treatment

- Obtain necessary state and federal permits, when and where required.
- Consult an archaeologist prior to initiation of work when the mechanical method to be used has the potential to affect cultural resource sites.
- Minimize soil disturbance as much as possible to prevent deeply buried invasive plant seeds being brought to the soil surface, promoting a sprouting event that could increase the density of the invasive plant species or create areas of bare soil that would provide an optimal seed bed in which new invasive species can sprout.
- Avoid non-target species damage to the extent practicable. Select mechanical methods to effectively control the target species (e.g. grubbing/hoeing is inappropriate for rhizomatous species and may increase the density of the invasive plant as root fragments sprout and become new plants).
- Apply mechanical treatments at the proper stage of plant growth when treatment will be most effective at controlling the target invasive plant.
- Thoroughly inspect and clean all equipment and clothing to remove invasive plant seeds or vegetative propagules to prevent the movement of the invasive plant to another site.
- To the extent practicable, conduct clipping and removal of seed stalks when seeds are at or nearing maturity to reduce inputs to the seed bank or when seeds are easily picked up and transported by vectors such as wind, humans or animals (e.g. wind-dispersed seeds such as rush skeletonweed or bur-like seeds such as houndstongue that cling to fur and clothing).

- Prior to burning to manage invasive plants, a prescribed burn plan will be completed and compliant with the Interagency Prescribed Fire Planning and Implementation Procedures Guide.
- Specific to aquatic invasive species, hand-pulling may be used when an infestation is very limited in extent and occurs close to the shoreline of a water body, but has not yet infested deeper waters.

Rehabilitation and Restoration

- Natural revegetation is the preferred option whenever possible. Assess invasive plant-infested sites to determine if the area is capable of natural recovery after control treatments. Determine what mix of desirable or native grass and forb plants still occur on the site and if they are numerous and vigorous enough to be capable of spreading vegetatively or via seed production.
- Assess erosion processes that may be affecting the site and the degree of severity of any soil erosion.
- Consider the most effective, practical and suitable means of providing rehabilitative or restorative measures, whether eliminating sources of disturbance other than invasive plants, or actions such as seeding and/or mulching.
- Consider the need to control invasive annual grasses, such as cheatgrass, and forbs, such as annual mustards, that are known to compete aggressively with perennial seedlings trying to establish.
- Determine whether additional assistive measures may be required, such as cover crops, hydraulic mulches, and mycorrhizal inoculums.
- Use native plants in rehabilitation and restoration where practicable.
- If it is determined that non-native species are the best choice for interim or permanent revegetation, be sure to select species that do not behave invasively under conditions similar to those at the site to be revegetated.
- Purchase only certified invasive plant-seed-free seed. Consider the use of site-adapted seed, if available and practicable.
- When seeding, determine the need for site preparation and protective measures that may need to be taken to allow the seeding to establish successfully.
- Plan revegetation activities at the optimal season and site conditions for successful establishment.
- Design seed mixes, whether native or desirable species, that are adapted to site conditions (including soil type, precipitation patterns, plant hardiness zones, etc.)
- Following establishment, continue to practice proper vegetation management to maintain a healthy, functioning plant community that is resilient to disturbance and resistant to invasive plant re-invasion.
- Use only invasive plant seed-free mulches and other products for uses such as erosion control and improved seed germination.
- Ensure that treatment tools and other equipment are free of invasive plant seeds before moving to or using on the project site.
- Minimize ground-disturbing activities to the extent possible during reseeding efforts.
- Consult an archaeologist prior to initiation of work when the method to be used has the potential to affect cultural resource sites.

Alternative 3- Proposed Action, Alternative 4- No Aerial Herbicide Application and Alternative 5- No Aquatic Herbicide Application

Biological Control

- Obtain Animal and Plant Health Inspection Service (APHIS) permit to Move Live Plant Pests, Noxious Weeds, or Soil for those agents when transportation across state lines is involved.
- Use only APHIS and State of Idaho approved biological control agents.
- Use Forest Service protocols for documentation of releases and monitoring and share release information with the Idaho State Department of Agriculture.
- To the extent practicable, collect biological control agents locally or from areas with similar climatic and weather conditions, land and soil types, and cover types to maximize successful establishment.
- Distribute biological control agents at the optimal season and life cycle stage to optimize the likelihood of successful establishment. Distribute quantities sufficient to optimize successful short-term establishment.
- For those agents that self-disperse poorly, actively assist the distribution throughout target infestations by redistribution (collecting and moving the agent to new locations).

Herbicide Application

General Herbicide Application

- Herbicide application shall comply with applicable laws (Idaho Statute Title 22, Chapter 34 and Idaho Administrative Code Rule 02.03.03), Forest Service policy and guidelines (FSH 2109 and FSM 2150), Endangered Species Act (ESA) section 7 consultation requirements, National Pollutant Discharge Elimination System (NPDES) permit requirements, and with product label directions for the herbicide being used to assure worker safety and to manage potential impacts of herbicide application.
- Always read and follow label directions, including instructions for herbicide use, application rates, equipment and techniques, personal protective equipment for applicators and mixers, and container disposal .
- See Appendix E regarding application of herbicides in proximity to water.
- Prior to implementation, program managers would ensure proper permitting is in place.
- Make sure Material Safety and Data Sheets, safety plans, spill prevention plans and cleanup kits are available to applicators and mixers, per the requirements of FSH 2109.
- Keep accurate and detailed application records, per Idaho Department of Agriculture Rules Governing Pesticide and Chemigation Use and Application and EPA requirements identified in the NPDES.
- Perform herbicide applications by or under the direct supervision of licensed Idaho professional herbicide applicators for forest and contract crews, per Idaho Department of Agriculture Rules Governing Pesticide and Chemigation Use and Application.

- Ensure that contracts and agreements include all of these design criteria as a minimum.
- Monitor wind speed and direction and equipment and spray parameters throughout an herbicide application. No herbicide shall be applied in sustained wind conditions exceeding five (5) miles per hour in riparian areas or in any wind conditions exceeding product label directions.
- Herbicide applicators would obtain a weather forecast for the area prior to initiating a spraying project to ensure no extreme precipitation or wind events were predicted to occur during or immediately after spraying that could allow runoff or drift into water bodies.
- Conduct equipment and personnel inspections, equipment maintenance and equipment calibration as needed to ensure proper herbicide application and to meet regulatory requirements. Regularly check equipment and components for wear. Attend to repairs and parts replacement promptly.
- Transport only the quantity of herbicide and adjuvants needed for a project. Secure containers being transported in such a way to prevent the likelihood of spills. Make periodic checks en route to help avoid spillage. Carry herbicides and adjuvants in water-tight, floatable containers when supplies need to be carried over water by boat, raft or other watercraft.
- When out in the field, use practical measures to restrict access to herbicides and adjuvants and spray equipment by unauthorized personnel.
- Off-highway vehicles (OHVs) used to transport or spray herbicides are administratively allowed to travel off designated motorized routes. These vehicles would not be taken off designated routes if damage to soils could occur due to wet conditions. Take care to ensure that disturbance to desirable vegetation is minimized and that no visible “trail” creation occurs.
- Follow the procedures in the SCNF Spill Plan in the event of a spill. Keep the SCNF Spill Plan compliant with NPDES.
- Use indicator dye in the herbicide mix to visually assure uniform coverage and minimize overlapped or skipped areas and treatment of non-target areas. Indicator dyes will be water-soluble and non-toxic.
- Within areas of special concern, such as developed recreation, trailheads, campsites and other high human areas, utilize treatments methods that minimize potential exposure to the public.
- To minimize herbicide drift during broadcast operations, use low pressure and larger droplet size to the extent possible with the equipment being used. Use nozzles designed for herbicide application.
- Equip water drafting equipment with back siphoning prevention devices.
- Wherever possible, mix and load at a distance greater than 100 feet from water and where spilled materials will not flow into groundwater, wetlands or streams.
- No broadcast application methods are used in riparian areas.
- Provide herbicide "awareness" information to forest users as opportunities arise. Treatment areas will be signed prior to herbicide applications within areas of special concern, such as trailheads, campsites, and other high use areas. Make information on where and when spraying and other treatments would occur available to the public at the local Ranger District office. Forest Service and other websites may also be used for public notification.

- Grazing permittees will be made aware of annual treatment actions at the permittee annual operating instruction meetings and/or if requested, notified in advance of spray dates.
- Follow label directions and other information sources to apply herbicides to the target species during phenological stages that optimize target control.
- To the extent practicable, apply herbicides to infestations containing biological control agents at times when the effects of herbicides to the host plants would not interfere with the agent's life cycle.
- Use a spray pattern that avoids application of herbicide to non-target species.

Sensitive Species

- Evaluate sites considered for herbicide treatment for sensitive plant habitat suitability. Survey suitable habitat as necessary prior to treatment. The need for field surveys in suitable habitat is based on factors such as plant phenology at the time of treatment and species' susceptibility to the herbicide(s) being used.
- Mechanical treatment, individual plant treatment (e.g. wiping), or spot herbicide application are preferred methods when treating invasive plant infestations associated with sensitive plant populations.
- For identified sensitive plant populations, there would be a 50-foot no spray zone for all herbicides applied by broadcast-type spray equipment (e.g. vehicle or helicopter- mounted booms or boomless sprayers).
- Glyphosate would only be applied within a 50-foot buffer if the sensitive plant species is dormant. Remaining herbicides may be applied following label instructions.

Aerial Herbicide Application

- The Aerial Herbicide Application Coordination and Safety Implementation Plan would be followed (Appendix F).
- Provide a minimum buffer of 300 feet for aerial herbicide application around developed campgrounds and private land (unless otherwise authorized by adjacent private landowners).
- All live water (perennial streams, flowing intermittent streams, lakes, ponds, springs, and wetlands) would have a 300 foot no application aerial herbicide buffer.
- Aerial herbicide application would not occur in designated municipal watersheds. Idaho DEQ Source Protection Areas would not be included in aerial application project areas.
- Aerial herbicide applications would not occur in Research Natural Areas (RNAs) or proposed wilderness areas. No aerial application would occur within ¼ mile of Designated Wild, Scenic System River (includes Recreation classification) and rivers determined to be eligible for inclusion in the System.
- Aerial herbicide application would not occur over areas with >30% live tree canopy cover.
- Aerial herbicide application would not occur over whitebark pine stands.
- Within known or potential sage-grouse nesting/early brood-rearing habitat, any aerial herbicide application would occur after June 30.

- Helicopters would avoid known raptor nest sites when flying to and from treatment sites and no aerial herbicide application would occur within ½ mile from known raptor nest sites during the following periods (or until young have fledged):
    - April 1 through August 31
    - bald eagles - February 1 through August 15
- Aerial herbicide application would not occur when sustained wind speeds exceed 5 mph or label recommendations.
- Aerial herbicide applications would not occur during inversions, or below minimum relative humidity or above maximum temperature, as stated on label.
- Herbicide applicators would obtain a weather forecast for the area prior to initiating a spraying project to ensure no extreme precipitation or wind events were predicted to occur during or immediately after spraying that could allow runoff or drift into water bodies.
- Considerations for choosing sites for aerial application would include the extent of the invasive plant infestation, the cumulative size of the infestation (many small sites in close relative proximity of each other), and the density of the invasive species.
- Aerial treatment areas could be treated recurrently on a 2 or 3-year rotation to ensure effective control. Monitoring would show which areas would need to be re-treated or if treatment areas can be reduced based on effectiveness of previous treatment.
- Public notification would be conducted through press releases in local newspapers and the use of social media and websites which that identify the potential windows of treatment for specific areas. Signing and on-site layout would be performed one to two weeks prior to actual aerial treatment.
- Temporary area, trail, and road closures would be used to ensure public safety during aerial spray operations.
- Grazing permittees would be notified that aerial application would be conducted and of the specific time frames in which treatment would occur to allow the option to remove grazing animals from the area.
- Aerial spray units (and perennial seeps, ponds, springs, and wetlands in proposed aerial units) would be identified prior to spraying to ensure only appropriate portions of the unit are aerially treated. A GPS system would be used in spray helicopters and each treatment unit mapped before the flight to ensure that only areas marked for treatment are treated. Drift monitoring cards would be placed out to 300 feet from and perpendicular to perennial streams to monitor herbicide presence as needed (Appendix G).

Aquatic Herbicide Application

- Perform herbicide applications by or under the direct supervision of licensed Idaho professional herbicide applicators with Aquatic Pest Control certifications.
- Aquatic applications would not be applied aerially.
- When the product label recommends use of an adjuvant, only aquatic-approved adjuvant may be used.
- Conduct evaluation of the infested site to determine best control method, including (a) location, number and extent of infestations, (b) depth, flow, substrate, water quality and configuration of the water body involved, (c) density and diversity of

native flora, and (d) direct and indirect effects to native flora and fauna and to people (e.g. domestic water use).

- Consider whether to apply herbicide to entire body of water, or to areas with highest risk as vectors, such as boat ramps.
- Use label to determine what proportion of water body may be treated at one time without causing excessive oxygen depletion from decaying plant matter.
- Do not apply to water where invasive plants are not present if herbicide is not labeled for submerged vegetation. Prefer spot-spraying techniques when applying herbicides to emergent vegetation.
- Notify the public of dates and type of treatment and duration of closure period.
- In the event of a detection of an aquatic nuisance plant species, the applicable sections of Idaho's Aquatic Nuisance Species Plan (ID ISCTC 2007) will be followed.

Manual and Mechanical Treatment

- Obtain necessary state and federal permits, when and where required.
- Prior to any burning invasive species using a torching device, a prescribed burn plan will be completed and compliant with Forest Service Manual 5140 and the Interagency Prescribed Fire Planning and Implementation Procedures Guide, PMS 484.
- Consult an archaeologist prior to initiation of work to determine whether an archaeological survey is needed.
- Incidental weed pulling would not trigger Section 106 review, as there is a very low probability that it would have an adverse effect on an archaeological site.
- Minimize soil disturbance as much as possible to minimize germination of invasive plant seeds and bare soil.
- Avoid non-target species damage to the extent practicable. Select mechanical methods to effectively control the target species (e.g. grubbing/hoeing is inappropriate for rhizomatous species and may increase the density of the invasive plant population as root fragments sprout and become new plants).
- Apply mechanical treatments at the proper stage of plant growth when treatment will be most effective at controlling the target invasive plant.
- Thoroughly inspect and clean all equipment and clothing to remove invasive plant seeds or vegetative propagules to prevent the movement of the invasive plant to another site.
- To the extent practicable, conduct clipping and removal of seed stalks prior to seed maturity to reduce inputs to the seed bank or when seeds are easily picked up and transported by vectors such as wind, humans or animals.
- Specific to aquatic invasive plants, hand-pulling and/or smothering may be used when an infestation is very limited in extent and occurs close to the shoreline of a water body, but has not yet infested deeper waters.

Rehabilitation and Restoration

- Natural revegetation is the preferred option whenever possible. Assess invasive plant-infested sites or areas of disturbance (e.g. wildfire) to determine if the area is capable of natural recovery after weed control treatments. Determine what mix of

desirable or native grass and forb plants still occur on the site and if they are numerous and vigorous enough to be capable of spreading vegetatively or via seed production.

- Assess erosion processes that may be affecting the site and the degree of severity of any soil erosion.
- Consider the most effective, practical and suitable means of providing rehabilitative or restorative measures, whether eliminating sources of disturbance other than invasive plants, or taking actions such as seeding and/or mulching.
- Consider the need to control invasive annual grasses, such as cheatgrass, and forbs, such as annual mustards, that are known to compete aggressively with perennial seedlings trying to establish.
- Determine whether additional assistive measures may be required, such as cover crops, hydraulic mulches, and mycorrhizal inoculums.
- Follow the guidance for revegetation in FSM 2070- Vegetation Ecology.
- Use native plants in rehabilitation and restoration where practicable.
- If it is determined that non-native species are the best choice for interim or permanent revegetation, be sure to select species that do not behave invasively under conditions similar to those at the site to be revegetated.
- Purchase only certified invasive plant-seed free seed. Consider the use of site-adapted seed, if available and practicable.
- When seeding, determine the need for site preparation and protective measures that may need to be taken to allow the seeding to establish successfully.
- Plan revegetation activities for the optimal season and site conditions for successful establishment.
- Design seed mixes, whether native or desirable species, that are adapted to site conditions (including soil type, precipitation patterns, plant hardiness zones, etc.).
- Sites where restoration and rehabilitation treatments have been applied may need to be protected from grazing use through temporary fencing, livestock exclusion or other method appropriate to the sites to allow seeded plant establishment.
- Following establishment, continue to practice proper vegetation management to maintain a healthy, functioning plant community that is resilient to disturbance and resistant to invasive plant re-invasion.
- Use only invasive plant seed-free mulches and other products for uses such as erosion control and improved seed germination.
- Ensure that treatment tools and other equipment are free of invasive plant seed before moving to or using on the project site.
- Minimize ground-disturbing activities to the extent possible during reseeding efforts.
- Conduct rehabilitation and restoration activities only in areas with slope gradients less than 45%.
- Conduct rehabilitation and restoration activities only in areas with low or moderate landtype erosion hazard ratings.
- Consult an archaeologist prior to initiation of work to determine if an archaeological survey is needed.

Appendix K: Biocontrol Agents Released within the Salmon-Challis National Forest

Table K-1: Biocontrol agents released within the Salmon-Challis National Forest

Biological Control Agent	Common Name of Agent	Number of Releases	Total Number of Releases
Canada Thistle			36
Ceutorhynchus litura	Stem/root weevil	18	
Urophora cardui	Canada thistle gall fly	18	
Knapweed (Spotted and Russian)			553
Agapeta zoegana	Sulphur knapweed moth	7	
Cyphocleonus achates	Knapweed root weevil	422	
Larinus minutus	Lesser knapweed flower weevil	97	
Larinus obtusus	Blunt knapweed flower weevil	10	
Metzneria paucipunctella	Knapweed seedhead moth	15	
Terellia virens	Green knapweed clearwing fly	2	
Leafy Spurge			142
Apthona (mix of 4 species)	Spurge flea beetle	127	
Hyles euphorbiae	Leafy spurge hawkmoth	1	
Oberea erythrocephala	Leafy spurge stem-boring weevil	11	
Spurgia esulae	Leafy spurge tip gall midge	3	
Toadflax (Dalmatian and Yellow)			14
Mecinus janthinus	Stem-boring weevil	14	
Total			**745**

Appendix L: Regional Weed Management Research Studies Informing the Vegetation Analysis

Table L-1: Regional weed management research studies informing the vegetation analysis

Study	Primary Researcher(s)	Years Studied	Year Reported	Location
Herbicide Applications for Control of Spotted Knapweed (Rice et al 1992, Rice and Toney 1996, Rice et al 1997, Rice and Toney 1998)	Bedunah, Carpenter, Rice, Toney	1988 – 1996	1992, 1996, 1997, 1998	Missoula County, MT
Effects of Picloram Application (Ortega and Pearson 2005, 2010, 2011)	Ortega and Pearson	2003-2008	2005,2010, 2011	Lolo National Forest
Sawmill Creek Research Natural Area Restoration Project (Rice 2000, Rice and Harrington 2007)	Rice and Harrington	1995 – 2006	2003, 2007	Bitterroot National Forest
Spotted Knapweed, Forb and Grass Response to Herbicide Treatments Sheley and Jacobs 1997, Sheley et al 2000, Sheley et al 2002)	Sheley	1996 – 1997	1997, 2000, 2002	Missoula and Powell Counties, MT
Flying D Ranch Forb Study (Pokorny et al 2004)	Pokorny and Sheley	2000 - 2001	2004	Gallatin County, MT
Non-Target Effects of Broadleaf Herbicide on a Native Perennial Forb (Crone et al. 2009)	Crone, marler and Pearson	2002-2007	2009	Missoula County, MT
Big Game Winter Range/Burned Area Weed Management (Rice 2012)	Rice	2002 - 2011	2012	Lolo National Forest
Gibbons Pass Aerial Spray Monitoring Plot Winter Range Restoration Project (Rice 2013b)	Rice	2004 - 2012	2013	Bitterroot National Forest
Non-Target Forb Response Aminopyralid (Halstvedt and Rice 2009, Halstvedt et al 2010, Rice 2013a)to Aminopyralid	Halstvedt, Rice	2008 - 2012	2009, 2010, 2013	Missoula County, MT

Appendix M: Herbicide Application Scenarios

Spot Herbicide Application

A square acre is approximately 208 feet on a side. Spotted knapweed is scattered across this acre of land and comprises approximately 10 percent of the plant community. Hoary alyssum, a biennial mustard, is present in a number of small patches intermixed with the spotted knapweed. Cheatgrass is also present in a few, small cells throughout the treatment area. Dominant native grasses are bluebunch wheatgrass and Sandberg's bluegrass. Dominant native forbs are arrowleaf balsamroot and lupine species (*Lupinus* spp). The site is situated on a bench in a sage/grass plant community and is more than half a mile from live water.

After assessing the site, the weed manager determines that herbicide application is appropriate to reduce spotted knapweed and cheatgrass density and selects the best application method, herbicides and application rate by consulting herbicide labels and risk assessments. A spot application method is selected since the area is not densely infested by the target weed species. Two herbicides to be applied at the same time (known as a tank mix) are selected. The herbicide picloram is chosen, with an application rate of 24 ounces/acre, because it is a very effective herbicide against spotted knapweed. This herbicide retains its effectiveness in the top layer of the soil profile for a period of time. In the coming year when more spotted knapweed seeds sprout, the small amount of residual picloram in the soil will kill the germinating, providing the equivalent of two applications for the cost and time of one. A low application rate of 24 ounces/acre is chosen because arrowleaf balsamroot, like spotted knapweed, is in the sunflower family and is sensitive to picloram. Unlike spotted knapweed, however, arrowleaf balsamroot has a very large and very deep root system. It will be able to survive and recover from a low use while the mortality rate of spotted knapweed will be high (Rice and Toney 1998). The other herbicide selected for application is imazapic, made at a use rate of 5 ounces/acre. Imazapic is an herbicide developed for use in restoration projects. It is very effective on mustards and on cheatgrass. Imazapic is effective on young, actively growing weeds at low use rates, while mature desirable plants are tolerant of imazapic. Selecting imazapic allows the weed manager to target the hoary alyssum and cheatgrass in the same application and does not affect the bluebunch wheatgrass and Sandberg's bluegrass. Using indicator dye, which helps applicators see exactly where they are applying herbicides, a spot application of picloram and imazapic is made to target weed plants and to the seedfall area around them. The spot application targets spotted knapweed, hoary alyssum and cheatgrass and is applied to approximately 10 percent of the acre overall. This example of spot application is also illustrative of applications made in riparian areas.

Ground-based Broadcast Herbicide Application

A typical broadcast application within the Salmon-Challis National forest (SCNF)is made along a heavily traveled one-mile road corridor to a popular campground. Due to the traffic, weed seeds are frequently introduced and spread along the road system by motor vehicles. A broadcast application is performed along the road using a utility vehicle (UTV) or spray truck. In this example, the road runs through sage/grass and conifer plant communities. Vegetation along the road margins is routinely cut back for road maintenance purposes and to maintain safe sight distances for drivers. It is fall and spotted knapweed and hoary alyssum seeds are

germinating along the road margins. The weed manager could apply glyphosate, a non-selective herbicide that kills all vegetation, in this setting, but decides to use 2,4-D instead at a rate of 16 ounces/acre to kill the broadleaf weeds and encourage grass species growing in the road margins. Retaining the grasses, which are short and do not interfere with road maintenance or sight distances, provides competition for weed seeds spread by vehicles, increasing the interval needed between herbicide applications. 2,4-D is an herbicide that works well on many young broadleaf weeds and stays in the soil for only a short period of time. During the application, a narrow strip of herbicide is broadcast on the road margins on each side of the road, extending out approximately 10 feet.

Aerial Herbicide Application

Weed managers would consider site characteristics (topography, cover types, vegetation structural stage, and weather and wind patterns), target and non-target vegetation, and herbicide and adjuvant selection (including the need for surfactant and drift control agents) when planning aerial applications of herbicide.

In this example, a large (about 100 acres) infestation of spotted knapweed is located in steep, rugged terrain beyond road and trail corridors. Neither all-terrain vehicles (ATVs) nor saddle and pack stock could access the infestations. The only access is on foot; however, the terrain poses a safety concern for weed control personnel. Additionally, there is no water source available for mixing herbicide. Under the current SCNF weed management program, ground-based application would be limited to backpack pumps, which is not feasible for cost and safety reasons.

The SCNF management objectives for the site include reducing the density of spotted knapweed and creating a containment line to slow the spread of spotted knapweed from this infestation. Due to its location, biological control agents have not been released in the infestation, although weed managers have confirmed that several biological control agents for spotted knapweed are dispersing into the infestation naturally from established insectaries some distance away. However, agents are not yet well-distributed and population levels are not sufficient to impact spotted knapweed. The spotted knapweed infestation is still expanding in density and distribution. Therefore, the infestation is essentially untreated due to inadequate population levels of biological control agents, safety concerns for personnel, the lack of a water source and the cost-prohibitive expense of a ground-based application. Based on these considerations, this site is a potential candidate for aerial application of herbicides.

Site characteristics include mixed cover types of grass, evergreen shrub and ponderosa pine on steep slopes (>50 slope) on westerly and southerly aspects. The ponderosa pine cover type is distributed in patches on favorable sites with deeper, more moisture-retentive soils, such as at the head of draws. The site has burned within the past 15 years and some of the conifer patches that burned contain only snags. The evergreen shrub cover type consists primarily of sagebrush (*Artemisia* spp.) and green rabbitbrush (*Chrysothamnus viscidiflorus*). Much of the evergreen shrub cover type burned in the fires within the past 15 years. Green rabbitbrush has re-colonized in the burned area. The sagebrush species on site do not re-sprout from the root crown after fire and sagebrush is only slowly beginning to re-establish. There are no live streams within 0.5 mile of the infestation, although there are several small seeps that usually contain some surface water through the month of June. Spotted knapweed cover (> 25% knapweed cover) is dense and there is reduced abundance and cover of desirable native forbs.

Based on cover types, structural stage, target and non-target plant species, weed managers narrow the choice of herbicides down to two: aminopyralid and clopyralid. These two herbicides were selected because they are effective in controlling spotted knapweed, provide residual control of germinating seeds and have less effect on non-target vegetation than other herbicides (e.g. dicamba or picloram). An application rate of 5 ounces per acre is selected for aminopyralid and an application rate of 20 ounces per acre is selected for clopyralid. Clopyralid would be applied over and near patches of green living conifers while aminopyralid would be applied throughout the rest of the treatment unit.

Internal and external communications and coordination would be implemented in conjunction with project development. Coordination, safety and operational project elements would be initiated (Appendix F). A staging area and other helicopter landing zones would be identified. These sites would be located as close to the treatment unit(s) as possible and more than 300 feet from water bodies. All herbicide mixing and loading and helicopter operations would occur at the staging area. There would be no overflight of human habitation by a helicopter carrying a load of herbicide.

Rain is generally infrequent from July through September on SCNF. Wind patterns at the treatment unit are generally upslope in the morning with shifts to downslope in the afternoon. There can be locally gusty winds in the afternoons associated with passing lightning storm cells. However, it is usually calm until mid-morning. Weed managers would monitor ten-day weather forecasts and morning and afternoon weather forecasts from the National Interagency Fire Center in the week before a scheduled aerial application. On site weather information may also be collected at the treatment unit during the operation as needed. The need for drift reduction agents and the appropriate nozzle size and sprayer system pressure would be adjusted as needed during operations by the contractor.

SCNF would implement an aerial herbicide application using the following general procedures under the Aerial Herbicide Application Coordination and Safety Implementation Plan:

Make initial notifications to all relevant program managers

- SCNF weed managers would notify the Forest Supervisor, District Ranger and other program managers as well as BLM and County Weed program managers of the upcoming application.

Coordinate with applicable resource specialists to define suitable treatments

- Consider site specific factors such as watershed drainage areas, streamflow, topography, and soil type when defining the location of aerial treatments, the size of treatment areas, and specific herbicides to be used.
- Identify specific avoidance areas related to riparian buffers, wildlife considerations, and human uses.

Organize resources (personnel, equipment, funds)

- The SCNF would determine and organize the resources needed to conduct inventories for weed and TEPS plants in the proposed treatment unit(s), establish a communications system and implement monitoring.
- Solicit proposals from qualified contractors for the aerial application and award contract.

Establish external communications system

- Identify nearby landowners and forest permittees of the application and tentative dates.
- The SCNF would announce the aerial application prior to the tentative application dates to inform the general public. A variety of communication tools could be used including e-mail, phone calls, letters, personal visits, website posts, radio, newspaper, etc.

Launch control actions

- Inventory weed infestations in treatment unit for up-to-date information on weed cover and distribution.
- Inventory treatment unit for the presence of sensitive plant species.
- GPS excluded areas (seeps, sensitive plant populations).
- Install drift detection monitoring along perennial and intermittent streams within or near (within 300 feet) the treatment units.
- Monitor weather forecasts prior to the application and obtain spot weather forecasts using portable weather kits, as needed.
- Adjust date and time of application.
- Implement aerial application.

Institute monitoring

- The site would be monitored on a regular basis to determine treatment efficacy, need for follow-up treatments and to document non-target effects.

Evaluate the response

- SCNF would conduct an After Action Review to determine how well procedures for implementing aerial application worked. The review would assess strengths of the response, weaknesses and means of improving the process for future applications.

Aquatic Broadcast Herbicide Application- Submersed Aquatic Invasive Plant Infestation

A new infestation of Eurasian watermilfoil (EWM) has been found at a small lake representative of natural lakes on SCNF. The lake is a popular recreation destination for people who like to boat and fish from small watercraft such as canoes, pontoon boats or float tubes. The lake is stocked with rainbow trout.

This lake is mesotrophic. The entire shoreline has a littoral zone about 20 feet out from shore with shallow water (average of 5 feet deep). It is a small, shallow lake of around 25 surface acres with a water depth of no more than 40 feet. It has a silty substrate and a moderate degree of turbidity (suspended particles in water). The lake provides habitat for a variety of native shoreline and macropytic plants (e.g. duckweed, algae and pond lilies).

In this example, EWM was brought to the lake as plant fragments on a canoe and boat trailer. EWM established at the boat ramp from these plant fragments (a primary means of reproduction for this weed species) and was found during regular surveys for aquatic invasive plants. The infestation is less than 0.1 acre in size.

There are a number of factors that weed managers would use to determine the appropriate treatment for EWM at the lake and measures that would need to be taken to prevent the spread of EWM to other nearby water bodies. Idaho has a set response to the detection of new aquatic invaders, including the following:

Verify reported detection

- Once the EWM infestation was detected, SCNF weed managers would collect samples for verification of the identification of the weed species

Make initial notifications to all relevant program managers

- SCNF weed managers would notify the Forest Supervisor, District Ranger and other program managers (e.g. range, recreation and special uses) as well as the County Weed Program Manager

Define extent of colonization

- SCNF would conduct another inventory of the lake to detect additional EWM infestations and would also inventory other nearby water bodies to learn if the EWM was confined to just the one lake or already present in these other water bodies.

Set up interagency response management team

- SCNF would coordinate with the Idaho state aquatic invasive species coordinator and relevant weed program managers in the county in which the infestation is located.

Establish external communications system

- The interagency response management team would work together to identify water users who could be affected by the EWM infestation and by eradication efforts. A variety of communication tools could be used including e-mail, phone calls, letters, personal visits, website posts, radio, newspaper, etc.

Organize resources (personnel, equipment, funds)

- The interagency response management team would determine and organize the resources needed to conduct inventories for other water bodies potentially infested by EWM, notify water users, set up the eradication treatment and initiate a monitoring program.

Prevent further spread via quarantine and pathway management

- Since the risk of vectoring EWM to other nearby water bodies would be very high, SCNF weed managers would recommend to the Forest Supervisor and District Ranger that an emergency closure order be placed in effect for the lake at least until the initial phase of treatment and monitoring was complete.

Launch available /relevant control actions

- In order to determine the treatment options available to eradicate the EWM, weed managers would need to define the characteristics of the EWM infestation, the characteristics of the lake and human uses of the lake and its water. In this example, the lake is not used as a reservoir or for potable water. However, the creek that is the lake's outlet is used for stock watering on private lands lower in the drainage. Water users would need to be informed of the EWM infestation and treatment options under consideration.
- Weed managers would consider the available range of treatment options to eradicate the EWM. Eradication is the SCNF management objective for aquatic invasive plants because they are new invaders that are not present elsewhere on SCNF. Eradication helps prevent the movement of aquatic invaders from one water body to another.
- Weed managers determine that drawdown of the lake, biological control, cultural and mechanical treatment methods are not effective in eradicating this infestation of EWM (ISDA 2008 EWM Plan). Drawdown to drain the lake and kill the EWM is not an option since this is a natural lake and not a reservoir. Biological control agents are not available for EWM because potential agents have been found to attack native milfoil species. Moreover, biological control is not a treatment that provides eradication. Cultural methods are not highly effective on EWM and are usually used when other options are not available. Mechanical methods (e.g. EWM spreads by plant fragments and mechanical treatment could further the spread of EWM in the lake).
- In this example, weed managers determine that herbicide would be the best treatment option to eradicate the EWM. Factors to consider in determining herbicide selection include the target weed species, presence of native plants, surface area of the water body, depth of water at the site of the weed infestation, turbidity, water exchange rate, and the desired final concentration of herbicide.
- Of the two aquatic herbicides suitable for EWM that are being proposed for use on SCNF, triclopyr triethylamine salt (TEA) and Imazamox, weed managers selected triclopyr TEA based on a literature search for the best eradication methods for EWM and the herbicide labels. The formulation chosen is a granular formulation. These granules are formulated to break down at a specific depth in the water column (Renovate OTF herbicide label). There are no restrictions on livestock consumption from treated water (Renovate OTF herbicide label). Neither are there restrictions on recreational use of treated water or non-food crop irrigation.
- Based on site and infestation characteristics, weed managers make the calculations necessary to apply triclopyr granules to the EWM infestation (Renovate OTF herbicide label). The EWM infestation is 1,000 square feet in size. The average water depth at the infestation site is 4 feet. Based on the herbicide label, weed managers determine that a concentration of 1.25 parts per million is sufficient to control EWM. The calculation for the amount of triclopyr TEA granules is:
- 1,000 ft2/43,560 ft2 per acre X 4-foot water depth X 1.25 parts per million X 27 (constant) = 3.1 pounds (weight) of tricropyr TEA granules needed for the application. The 3.1 pounds of triclopyr TEA granules would be spread over the 1,000 square feet EWM infestation using a hand spreader. Per label directions, treatment would begin at the shoreline and progress outward in bands to allow fish

and wildlife species to move out of the treatment area (Renovate OTF herbicide label).

Institute long-term monitoring

- The lake would need to be monitored on a regular basis to determine treatment efficacy, need for follow-up treatments and to document non-target effects.

Evaluate the response and Rapid Response Plan

- SCNF and the interagency response team would conduct an After Action Review to determine how well the rapid response strategy worked for eradicating EWM at this lake. The review would assess strengths of the response, weaknesses and means of improving the response in order to be better-prepared in the future.

Aquatic Broadcast Herbicide Application - Floating Aquatic Invasive Plant Infestation

This example is set at the same representative lake as the EWM example. An infestation of water hyacinth, a new addition to the Idaho Noxious Weed List, was detected in shallow water near the boat ramp. Water hyacinth is a free-floating perennial aquatic plant with leaves that float above the water. It is the fastest-growing plant known and infestations can double in size in two weeks in favorable conditions. If not controlled, water hyacinth can completely cover lakes and ponds. In this example, the infestation is approximately 0.25 acre in size.

The process to eradicate this infestation is the same as that illustrated in the EWM example. There are a number of factors that weed managers would use to determine the appropriate treatment for water hyacinth and measures that would need to be taken to prevent the spread of water hyacinth to other nearby water bodies. Idaho has a set response to the detection of new aquatic invaders, including the following:

Verify reported detection

- Once the water hyacinth infestation was detected, SCNF weed managers would collect samples for verification of the identification of the weed species

Make initial notifications to all relevant program managers

- SCNF weed managers would notify the Forest Supervisor, District Ranger and other program managers (e.g. range, recreation and special uses) as well as the County Weed Program Manager

Define extent of colonization

- SCNF would conduct another inventory of the lake to detect additional water hyacinth infestations and would also inventory other nearby water bodies to learn if water hyacinth was confined to the lake in which it was first found or already present in these other water bodies.

Set up interagency response management team

- SCNF would coordinate with the Idaho state aquatic invasive species coordinator and relevant weed program managers in the county in which the infestation is located.

Establish external communications system

- The interagency response management team would work together to identify water users who could be affected by the water hyacinth infestation and by eradication efforts. A variety of communication tools could be used including e-mail, phone calls, letters, personal visits, website posts, radio, newspaper, etc.

Organize resources (personnel, equipment, funds)

- The interagency response management team would determine and organize the resources needed to conduct inventories for other water bodies potentially infested by water hyacinth, notify water users, set up the eradication treatment and initiate a monitoring program.

Prevent further spread via quarantine and pathway management

- Since the risk of vectoring water hyacinth to other nearby water bodies would be very high, SCNF weed managers would recommend to the Forest Supervisor and District Ranger that an emergency closure order be placed in effect for the lake at least until the initial phase of treatment and monitoring was complete.

Launch available /relevant control actions

- In order to determine the treatment options available to eradicate the water hyacinth, weed managers would need to define the characteristics of the infestation, the characteristics of the lake and human uses of the lake and its water. In this example, the lake is not used as a reservoir or for potable water. However, the creek that is the lake's outlet is used for stock watering on private lands lower in the drainage. Water users would need to be informed of the water hyacinth infestation and treatment options under consideration.
- Weed managers would consider the available range of treatment options to eradicate the water hyacinth. Eradication is the SCNF management objective for aquatic invasive plants because they are new invaders that are not present elsewhere on SCNF. Eradication helps prevent the movement of aquatic invaders from one water body to another.
- Weed managers determine that drawdown, biological control, cultural and mechanical treatment methods are not effective in eradicating this infestation. Drawdown is not an option. Biological control is not appropriate for this infestation because it does not provide eradication. Cultural methods would not be highly effective. Mechanical methods could further the spread of the weed.
- In this example, weed managers determine that herbicide would be the best treatment option to eradicate the water hyacinth. Factors to consider in determining herbicide selection include the target weed species, presence of native plants, surface area of the water body, depth of water at the site of the weed infestation, turbidity, water exchange rate, and the desired final concentration of herbicide.
- The aquatic herbicides proposed for use on SCNF include glyphosate, triclopyr TEA, imazapyr and imazamox. Weed managers select a liquid formulation of imazamox at a target rate of 32 oz/acre (Clearcast herbicide label). The label for imazamox directs the use of a surfactant to reduce water tension. Weed managers selected a

modified seed oil at 24 ounces/acre for this purpose because it is permitted by the herbicide label and is non-toxic. There are no restrictions on irrigation use, livestock watering or recreational use of treated water (Clearcast herbicide label).

- Based on site and infestation characteristics, weed managers calculate that 8.0 ounces of imazamox would be required to treat the 0.25-acre infestation growing as a mat on the water. The 8.0 ounces of imazamox would be applied as a foliar spray over the top of the water hyacinth plants using a hand sprayer.
- Institute long-term monitoring
- The lake would need to be monitored on a regular basis to determine treatment efficacy, need for follow-up treatments and to document non-target effects.
- Evaluate the response and Rapid Response Plan
- The SCNF and the interagency response team would conduct an After Action Review to determine how well the rapid response strategy worked for eradicating water hyacinth in this lake. The review would assess strengths of the response, weaknesses and means of improving the response in order to be better-prepared in the future.

Appendix N: Cumulative Effects Analysis for Watershed Condition

Table N-1: Watershed Condition Cumulative Effects Risk Analysis for the Effects of Invasive Plant Infestations by Sixth-level Watershed.

Hydrologic Unit Code	Watershed Name	Watershed Size (acres)	Acres of Inventoried Invasive Plant Infestation	Percent of Watershed Infested	Watershed Condition Class (2011)	Cumulative Effects Risk by Alternative				
						Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
170402160101	Spring Mountain Canyon-Birch Creek	13,689	10.6	0.1%	1	L	L	L	L	L
170402170201	Upper Sawmill Creek	25,847	365.2	1.4%	2	M	L	L	L	L
170402170202	Middle Sawmill Creek	25,286	243.5	1.0%	2	M	L	L	L	L
170402170401	Upper Wet Creek	27,817	235.9	0.8%	1	L	L	L	L	L
170402170503	Badger Creek	11,096	0.1	0.0%	1	L	L	L	L	L
170402170504	Williams Creek-Little Lost River	37,064	0.1	0.0%	1	L	L	L	L	L
170402170602	North Creek	12,294	7.9	0.1%	2	L	L	L	L	L
170402170604	Sands Canyon-Little Lost River	44,792	127.5	0.3%	1	L	L	L	L	L
170402170701	Taylor Creek-Cedarville Canyon	33,064	3.7	0.0%	1	L	L	L	L	L
170402170702	Hurst Creek	20,135	18.3	0.1%	1	L	L	L	L	L
170402170705	Little Lost River Sinks	28,936	0.1	0.0%	1	L	L	L	L	L
170402180101	Upper Star Hope Creek	21,193	136.5	0.6%	2	L	L	L	L	L
170402180102	Lower Star Hope Creek	27,298	69.4	0.3%	1	L	L	L	L	L
170402180201	Headwaters East Fork Big Lost River	20,188	34.5	0.2%	1	L	L	L	L	L
170402180202	Upper East Fork Big Lost River	25,483	113.9	0.4%	1	L	L	L	L	L
170402180203	Middle East Fork Big Lost River	20,796	41.2	0.2%	2	L	L	L	L	L
170402180205	Wildhorse Creek	22,186	4.0	0.0%	2	L	L	L	L	L
170402180206	Lower East Fork Big Lost	23,672	0.4	0.0%	1	L	L	L	L	L

Hydrologic Unit Code	Watershed Name	Watershed Size (acres)	Acres of Inventoried Invasive Plant Infestation	Percent of Watershed Infested	Watershed Condition Class (2011)	Cumulative Effects Risk by Alternative				
						Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
	River									
170402180301	Upper North Fork Big Lost River	23,848	14.1	0.1%	1	L	L	L	L	L
170402180303	Summit Creek	17,433	162.1	0.9%	2	L	L	L	L	L
170402180304	Lower North Fork Big Lost River	20,340	6.5	0.0%	2	L	L	L	L	L
170402180402	Pinto Creek-Big Lost River	26,807	8.3	0.0%	1	L	L	L	L	L
170402180502	Willow Creek-Thousand Springs Creek	37,003	101.9	0.3%	1	L	L	L	L	L
170402180503	Cedar Creek-Thousand Spring Creek	29,251	0.6	0.0%	2	L	L	L	L	L
170402180504	Lehman Creek-Warm Springs Creek	28,372	2.0	0.0%	1	L	L	L	L	L
170402180505	Navarre Creek	9,951	127.5	1.3%	2	M	L	L	L	L
170402180506	Lone Cedar Creek-Big Lost River	50,225	0.1	0.0%	2	L	L	L	L	L
170402180601	Headwaters Antelope Creek	14,257	161.6	1.1%	1	L	L	L	L	L
170402180602	Iron Bog Creek	15,061	10.0	0.1%	1	L	L	L	L	L
170402180603	Bear Creek	12,088	41.4	0.3%	1	L	L	L	L	L
170402180604	Upper Antelope Creek	17,873	65.7	0.4%	1	L	L	L	L	L
170402180605	Dry Fork Creek	25,330	0.1	0.0%	1	L	L	L	L	L
170402180606	Cherry Creek	33,352	140.0	0.4%	2	L	L	L	L	L
170402180607	Middle Antelope Creek	18,911	0.6	0.0%	1	L	L	L	L	L
170402180608	Lower Antelope Creek	24,399	204.0	0.8%	1	L	L	L	L	L
170402180701	Lower Cedar Creek-Big Lost River	38,240	151.1	0.4%	1	L	L	L	L	L
170402180702	Alder Creek	24,581	34.5	0.1%	2	L	L	L	L	L
170402180703	Pass Creek	25,326	198.2	0.8%	2	L	L	L	L	L

Hydrologic Unit Code	Watershed Name	Watershed Size (acres)	Acres of Inventoried Invasive Plant Infestation	Percent of Watershed Infested	Watershed Condition Class (2011)	Cumulative Effects Risk by Alternative				
						Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
170402180704	Willow Creek-Big Lost River	37,266	4.2	0.0%	1	L	L	L	L	L
170402180705	Elbow Canyon	10,881	4.0	0.0%	1	L	L	L	L	L
170402180706	Ramshorn Creek-Big Lost River	38,983	62.3	0.2%	1	L	L	L	L	L
170402180802	Combe Canyon	43,857	7.9	0.0%	1	L	L	L	L	L
170402180803	Rocky Creek-Big Lost River	168,385	43.5	0.0%	1	L	L	L	L	L
170402210401	Upper Fish Creek	21,183	5.3	0.0%	1	L	L	L	L	L
170602010502	Middle Yankee Fork	28,383	24.3	0.1%	1	L	L	L	L	L
170602010503	Jordan Creek	10,484	23.8	0.2%	2	L	L	L	L	L
170602010504	West Fork Yankee Fork	36,953	0.1	0.0%	1	L	L	L	L	L
170602010505	Lower Yankee Fork	18,565	552.0	3.0%	1	L	L	L	L	L
170602010601	Big Casino Creek-Salmon River	22,678	2.4	0.0%	1	L	L	L	L	L
170602010602	Basin Creek	33,697	27.7	0.1%	1	L	L	L	L	L
170602010603	Rough Creek-Salmon River	23,329	28.9	0.1%	1	L	L	L	L	L
170602010801	Upper Squaw Creek	19,189	0.3	0.0%	1	L	L	L	L	L
170602010802	Middle Squaw Creek	18,796	60.9	0.3%	1	L	L	L	L	L
170602010803	Lower Squaw Creek	12,148	8.9	0.1%	2	L	L	L	L	L
170602010902	Peach Creek-Salmon River	25,966	45.4	0.2%	1	L	L	L	L	L
170602010903	Thompson Creek	19,348	154.1	0.8%	1	L	L	L	L	L
170602010905	Kinnikinic Creek	11,104	16.7	0.2%	1	L	L	L	L	L
170602010906	Sullivan Creek-Salmon River	21,805	11.8	0.1%	1	L	L	L	L	L
170602011105	Pine Creek-East Fork Salmon River	20,237	0.2	0.0%	1	L	L	L	L	L
170602011403	Bayhorse Creek	15,362	2.4	0.0%	1	L	L	L	L	L
170602011601	Upper Challis Creek	20,794	6.4	0.0%	2	L	L	L	L	L
170602011602	Middle Challis Creek	14,408	2.3	0.0%	2	L	L	L	L	L
170602011603	Eddy Creek	13,499	36.1	0.3%	1	L	L	L	L	L

Hydrologic Unit Code	Watershed Name	Watershed Size (acres)	Acres of Inventoried Invasive Plant Infestation	Percent of Watershed Infested	Watershed Condition Class (2011)	Cumulative Effects Risk by Alternative				
						Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
170602011604	Mill Creek	18,020	126.5	0.7%	1	L	L	L	L	L
170602011606	Lower Challis Creek	22,322	0.1	0.0%	1	L	L	L	L	L
170602011701	Upper Morgan Creek	14,216	42.5	0.3%	2	L	L	L	L	L
170602011702	Middle Morgan Creek	24,981	212.8	0.9%	2	L	L	L	L	L
170602011703	West Fork Morgan Creek	13,865	342.8	2.5%	1	L	L	L	L	L
170602011704	Lower Morgan Creek	15,623	54.4	0.3%	1	L	L	L	L	L
170602011801	Leaton Gulch-Salmon River	22,753	33.4	0.1%	1	L	L	L	L	L
170602011802	Garden Creek	21,447	50.8	0.2%	1	L	L	L	L	L
170602020202	Mud Spring Canyon	24,982	2.4	0.0%	1	L	L	L	L	L
170602020203	Christian Gulch	14,331	140.2	1.0%	1	L	L	L	L	L
170602020204	Doublespring Creek	28,766	51.7	0.2%	1	L	L	L	L	L
170602020206	North Fork Big Creek	17,996	5.4	0.0%	1	L	L	L	L	L
170602020207	Upper Big Creek	22,543	11.4	0.1%	1	L	L	L	L	L
170602020301	Grouse Creek	16,908	929.3	5.5%	1	M	L	L	L	L
170602020304	Upper Patterson Creek	20,005	93.7	0.5%	1	L	L	L	L	L
170602020306	Falls Creek	12,242	0.1	0.0%	2	L	L	L	L	L
170602020307	Morse Creek	11,682	90.8	0.8%	1	L	L	L	L	L
170602020309	Trail Creek	10,084	37.9	0.4%	1	L	L	L	L	L
170602020311	Lawson Creek	12,691	6.1	0.0%	1	L	L	L	L	L
170602020312	Morgan Creek	14,181	0.1	0.0%	1	L	L	L	L	L
170602020313	Lower Patterson Creek-Pahsimeroi River	58,430	0.2	0.0%	1	L	L	L	L	L
170602030101	Cow Creek	17,381	4.2	0.0%	2	L	L	L	L	L
170602030102	Little Hat Creek	19,306	40.1	0.2%	1	L	L	L	L	L
170602030103	Hat Creek	29,713	106.5	0.4%	1	L	L	L	L	L
170602030104	Allison Creek-Salmon River	22,016	363.8	1.7%	1	L	L	L	L	L
170602030201	McKim Creek	10,130	82.3	0.8%	1	L	L	L	L	L
170602030202	Poison Creek	11,683	34.0	0.3%	1	L	L	L	L	L

Hydrologic Unit Code	Watershed Name	Watershed Size (acres)	Acres of Inventoried Invasive Plant Infestation	Percent of Watershed Infested	Watershed Condition Class (2011)	Cumulative Effects Risk by Alternative				
						Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
170602030203	Cabin Creek-Salmon River	17,464	27.6	0.2%	1	L	L	L	L	L
170602030204	Upper Iron Creek	11,820	102.9	0.9%	1	L	L	L	L	L
170602030205	North Fork Iron Creek	11,862	212.5	1.8%	1	L	L	L	L	L
170602030206	Lower Iron Creek	13,491	216.3	1.6%	1	L	L	L	L	L
170602030301	Warm Springs Creek	13,350	1.8	0.0%	1	L	L	L	L	L
170602030302	Lake Creek	12,910	498.0	3.9%	1	L	L	L	L	L
170602030303	Twelvemile Creek	14,176	190.7	1.3%	1	L	L	L	L	L
170602030304	Rattlesnake Creek-Salmon River	28,816	145.3	0.5%	1	L	L	L	L	L
170602030305	Henry Creek-Salmon River	14,735	62.8	0.4%	1	L	L	L	L	L
170602030401	Williams Creek	18,015	728.1	4.0%	1	L	L	L	L	L
170602030402	Jesse Creek	12,915	44.7	0.3%	1	L	L	L	L	L
170602030403	Perreau Creek-Salmon River	36,790	1,042.4	2.8%	2	M	L	L	L	L
170602030404	Fenster Creek-Salmon River	20,534	372.6	1.8%	2	M	L	L	L	L
170602030501	Upper Carmen Creek	11,914	22.9	0.2%	1	L	L	L	L	L
170602030503	Lower Carmen Creek	11,335	0.4	0.0%	1	L	L	L	L	L
170602030504	Wallace Creek-Salmon River	24,730	645.8	2.6%	2	M	L	L	L	L
170602030505	Tower Creek	13,742	30.0	0.2%	1	L	L	L	L	L
170602030506	Fourth of July Creek	14,931	449.8	3.0%	1	L	L	L	L	L
170602030507	Wagonhammer Creek-Salmon River	25,544	1,062.8	4.2%	1	L	L	L	L	L
170602030601	Upper North Fork Salmon River	24,298	431.2	1.8%	1	L	L	L	L	L
170602030602	Dahlonega Creek	20,931	690.7	3.3%	1	L	L	L	L	L
170602030603	Middle North Fork Salmon River	17,127	1,512.3	8.8%	1	M	L	L	L	L
170602030604	Sheep Creek	24,554	193.6	0.8%	1	L	L	L	L	L
170602030605	Hughes Creek	26,111	2,424.9	9.3%	1	M	L	L	L	L

Hydrologic Unit Code	Watershed Name	Watershed Size (acres)	Acres of Inventoried Invasive Plant Infestation	Percent of Watershed Infested	Watershed Condition Class (2011)	Cumulative Effects Risk by Alternative				
						Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
170602030606	Lower North Fork Salmon River	22,294	4,670.4	20.9%	1	H	M	L	M	L
170602030701	Dump Creek-Salmon River	18,274	2,605.9	14.3%	2	H	H	M	H	M
170602030702	Moose Creek	25,372	222.9	0.9%	1	L	L	L	L	L
170602030703	Indian Creek	34,649	729.9	2.1%	1	L	L	L	L	L
170602030704	Squaw Creek	10,975	1,034.1	9.4%	1	M	L	L	L	L
170602030705	East Boulder Creek-Salmon River	19,313	1,486.7	7.7%	2	H	M	L	M	L
170602030801	Spring Creek	12,100	1,074.1	8.9%	1	M	L	L	L	L
170602030802	Boulder Creek-Salmon River	21,577	996.4	4.6%	1	L	L	L	L	L
170602030803	Pine Creek	18,974	1,422.2	7.5%	1	M	L	L	L	L
170602030804	Big Sheepeater Creek-Salmon River	12,565	211.2	1.7%	1	L	L	L	L	L
170602030901	Headwaters Panther Creek	17,678	287.7	1.6%	2	M	L	L	L	L
170602030902	Cabin Creek-Panther Creek	11,882	127.1	1.1%	1	L	L	L	L	L
170602030903	Musgrove Creek	15,178	56.0	0.4%	1	L	L	L	L	L
170602030904	Porphyry Creek-Panther Creek	11,565	310.6	2.7%	1	L	L	L	L	L
170602030905	Moyer Creek	26,583	190.2	0.7%	1	L	L	L	L	L
170602031001	Upper Napias Creek	14,062	123.2	0.9%	2	L	L	L	L	L
170602031002	Arnett Creek	12,064	91.1	0.8%	1	L	L	L	L	L
170602031003	Middle Napias Creek	19,029	142.5	0.7%	1	L	L	L	L	L
170602031004	Lower Napias Creek	11,384	117.4	1.0%	1	L	L	L	L	L
170602031101	Woodtick Creek	10,283	215.4	2.1%	1	L	L	L	L	L
170602031102	Copper Creek-Panther Creek	10,662	571.6	5.4%	1	M	L	L	L	L
170602031103	Blackbird Creek	13,340	152.8	1.1%	2	M	L	L	L	L
170602031104	Deep Creek	23,734	138.0	0.6%	1	L	L	L	L	L
170602031105	Fawn Creek-Panther Creek	11,067	186.0	1.7%	1	L	L	L	L	L

Hydrologic Unit Code	Watershed Name	Watershed Size (acres)	Acres of Inventoried Invasive Plant Infestation	Percent of Watershed Infested	Watershed Condition Class (2011)	Cumulative Effects Risk by Alternative				
						Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
170602031106	Little Deer Creek-Panther Creek	19,154	599.2	3.1%	1	L	L	L	L	L
170602031107	Big Deer Creek	29,383	164.0	0.6%	1	L	L	L	L	L
170602031201	Trail Creek-Panther Creek	23,301	735.0	3.2%	1	L	L	L	L	L
170602031202	Beaver Creek	11,531	1,878.8	16.3%	1	H	M	L	M	L
170602031203	Clear Creek	32,309	77.2	0.2%	1	L	L	L	L	L
170602031204	Garden Creek-Panther Creek	16,650	2,679.3	16.1%	1	H	M	L	M	L
170602031301	Owl Creek	34,433	899.4	2.6%	1	L	L	L	L	L
170602031302	Cove Creek-Salmon River	12,101	709.0	5.9%	1	M	L	L	L	L
170602031303	Colson Creek-Salmon River	18,629	1,049.4	5.6%	1	M	L	L	L	L
170602040101	Upper Texas Creek	30,568	82.5	0.3%	1	L	L	L	L	L
170602040102	Lower Texas Creek	31,834	87.0	0.3%	1	L	L	L	L	L
170602040201	Big Bear Creek	15,059	55.4	0.4%	1	L	L	L	L	L
170602040202	Reservoir Creek-Hawley Creek	25,486	96.1	0.4%	1	L	L	L	L	L
170602040303	Bull Creek-Eighteenmile Creek	16,701	10.2	0.1%	1	L	L	L	L	L
170602040401	Upper Timber Creek	23,345	7.7	0.0%	1	L	L	L	L	L
170602040402	Lower Timber Creek	28,902	71.0	0.2%	1	L	L	L	L	L
170602040501	Canyon Creek	37,707	560.3	1.5%	1	L	L	L	L	L
170602040503	Jakes Creek-Lemhi River	27,239	50.0	0.2%	1	L	L	L	L	L
170602040504	Little Eightmile Creek	12,526	53.0	0.4%	1	L	L	L	L	L
170602040505	Big Eightmile Creek	21,133	62.2	0.3%	1	L	L	L	L	L
170602040506	Lee Creek	13,757	109.4	0.8%	1	L	L	L	L	L
170602040507	Mill Creek	11,558	8.1	0.1%	1	L	L	L	L	L
170602040508	Peterson Creek-Lemhi River	21,615	5.1	0.0%	1	L	L	L	L	L
170602040510	Zeph Creek-Lemhi River	39,282	47.7	0.1%	1	L	L	L	L	L
170602040601	Upper Hayden Creek	20,183	67.9	0.3%	1	L	L	L	L	L

Hydrologic Unit Code	Watershed Name	Watershed Size (acres)	Acres of Inventoried Invasive Plant Infestation	Percent of Watershed Infested	Watershed Condition Class (2011)	Cumulative Effects Risk by Alternative				
						Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
170602040602	Middle Hayden Creek	11,576	380.1	3.3%	1	L	L	L	L	L
170602040603	Bear Valley Creek	19,739	361.7	1.8%	1	L	L	L	L	L
170602040605	Lower Hayden Creek	12,259	30.9	0.3%	1	L	L	L	L	L
170602040703	Agency Creek	28,551	92.7	0.3%	1	L	L	L	L	L
170602040704	Pattee Creek	15,869	93.5	0.6%	1	L	L	L	L	L
170602040705	Kenney Creek	16,084	0.8	0.0%	1	L	L	L	L	L
170602040706	Baldy Creek-Lemhi River	19,014	58.5	0.3%	1	L	L	L	L	L
170602040801	Haynes Creek	11,043	262.8	2.4%	1	L	L	L	L	L
170602040802	Sandy Creek-Lemhi River	29,363	0.1	0.0%	1	L	L	L	L	L
170602040803	Withington Creek	10,641	116.3	1.1%	2	M	L	L	L	L
170602040806	Baker Creek-Lemhi River	15,437	53.3	0.3%	1	L	L	L	L	L
170602050301	Knapp Creek	12,895	2.5	0.0%	2	L	L	L	L	L
170602050304	Lower Beaver Creek	19,179	7.3	0.0%	1	L	L	L	L	L
170602050305	Swamp Creek-Marsh Creek	29,503	0.5	0.0%	2	L	L	L	L	L
170602050501	Upper Rapid River	20,565	0.1	0.0%	1	L	L	L	L	L
170602050502	Seafoam Creek-Rapid River	20,436	0.1	0.0%	1	L	L	L	L	L
170602051001	Headwaters Loon Creek	32,238	1.6	0.0%	1	L	L	L	L	L
170602051003	Mayfield Creek	15,585	17.3	0.1%	1	L	L	L	L	L
170602051005	Canyon Creek-Loon Creek	24,800	73.5	0.3%	1	L	L	L	L	L
170602060104	Castle Creek	15,365	2.9	0.0%	1	L	L	L	L	L
170602060105	White Goat Creek-Camas Creek	16,703	118.6	0.7%	1	L	L	L	L	L
170602060202	Middle Yellowjacket Creek	20,523	252.5	1.2%	1	L	L	L	L	L
170602060203	Hoodoo Creek	11,337	3.3	0.0%	1	L	L	L	L	L
170602060204	Lower Yellowjacket Creek	19,425	212.1	1.1%	1	L	L	L	L	L
170602060301	Upper Silver Creek	17,689	599.4	3.4%	1	L	L	L	L	L
170602060302	Lower Silver Creek	15,648	205.3	1.3%	1	L	L	L	L	L
170602060303	West Fork Camas Creek	25,300	50.3	0.2%	1	L	L	L	L	L

Hydrologic Unit Code	Watershed Name	Watershed Size (acres)	Acres of Inventoried Invasive Plant Infestation	Percent of Watershed Infested	Watershed Condition Class (2011)	Cumulative Effects Risk by Alternative				
						Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
170602060304	Duck Creek-Camas Creek	18,916	345.4	1.8%	1	L	L	L	L	L
170602070101	Upper Horse Creek	19,389	168.9	0.9%	1	L	L	L	L	L
170602070104	Little Horse Creek	13,052	1.2	0.0%	1	L	L	L	L	L
170602070202	Bear Basin Creek-Salmon River	14,257	315.3	2.2%	1	L	L	L	L	L
170602070203	Corn Creek-Salmon River	18,414	45.8	0.2%	1	L	L	L	L	L
Grand Total			49,152							

Appendix O: Best Management Practices

Best Management Practices (BMPs) from the National Core BMP Technical Guide (USDA Forest Service, 2012b) and the Soil and Water Conservation practices Handbook (R1/R4 amendment) (USDA Forest Service 1988c) would be followed under all action alternatives. Table O-1 and Table O-2 provide a summary of the BMPs that are most applicable to this project. Table O-3 provides a summary of how these BMPs are linked to the project design criteria.

Table O-1: National Core Best Management Practices applicable to all action alternatives.

BMP	Title	Objective
Plan 2	Project Planning and Analysis	Use the project planning, environmental analysis, and decision making processes to incorporate water quality management BMPs into project design and implementation.
Plan 3	Aquatic Management Zone Planning	To maintain and improve or restore the condition of land around and adjacent to waterbodies in the context of the environment in which they are located, recognizing their unique values and importance to water quality while implementing land and resource management activities.
Chem 1	Chemical Use Planning	Use the planning process to develop measures to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources from chemical use on NFS lands.
Chem 2	Follow Label Directions	Avoid or minimize the risk of soil and surface water or groundwater contamination by complying with all label instructions and restrictions required for legal use.
Chem 3	Chemical Use Near Waterbodies	Avoid or minimize the risk of chemical delivery to surface water or groundwater when treating areas near waterbodies.
Chem 4	Chemical Use In Waterbodies	Avoid, minimize, or mitigate unintended adverse effects to water quality from chemical treatments applied directly to waterbodies.
Chem 5	Chemical Handling and Disposal	Avoid or minimize water and soil contamination when transporting, storing, preparing and mixing chemicals; cleaning application equipment; and cleaning or disposing chemical containers.
Chem 6	Chemical Application Monitoring and Evaluation	Determine whether chemicals have been applied safely, have been restricted to intended targets, and have not resulted in unexpected nontarget effects. Document and provide early warning of possible hazardous conditions resulting from potential contamination of water or other nontarget resources or areas by chemicals.
Veg 2	Erosion Prevention and Control	Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources by implementing measures to control surface erosion, gully formation, mass slope failure, and resulting sediment movement before, during, and after mechanical vegetation treatments.
Veg 3	Aquatic Management Zones	Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources when conducting mechanical vegetation treatment activities in the AMZ.
Veg 8	Mechanical Site Treatment	Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources by controlling the introduction of sediment, nutrients, chemical, or other pollutants to waterbodies during mechanical site treatment.

Table O-2: Soil and Water Conservation Practices Handbook (R1/R4 Amendment) Practices applicable to all action alternatives.

Practice	Title	Objective
13.07	Pesticide Use Planning	To incorporate water quality and hydrologic considerations into the Pesticide Use Planning Process.
13.08	Apply Pesticides According to Label and EPA Registration Directions	To avoid water contamination by complying with all label instruction and restrictions.
13.09	Pesticide Application Monitoring and Evaluation	To determine and document that pesticides have been applied safely and to provide an early warning for any contamination of water or non-target areas or resources.
13.10	Pesticide Spill Contingency Planning	To reduce contamination of water from accidental pesticide spills.
13.11	Cleaning and Disposal of Pesticide Containers and Equipment	To prevent water contamination and risk to humans from cleaning and disposal of pesticide containers.
13.12	Protection of Water, Wetlands, and Riparian Areas during Pesticide Spraying	To minimize the risk of a pesticide entering surface or subsurface waters or affecting riparian areas, wetlands, or other non-target areas.
13.13	Controlling Pesticide Drift During Spray Application	To minimize the risk of pesticide contaminating non-target areas.

Design criteria specifically related to soil and water that will be applied to this project, for the applicable portions of all action alternatives, are summarized in table O-3. Note that the Current Action Alternative also utilizes established mitigation measures, as well as terms and conditions, and conservation measures provided under the National Marine Fisheries Service Biological Opinion (USDC NMFS 2012). These project design criteria tier to the Best Management Practices (BMPs) in the Forest Service National Core BMP Technical Guide (USDA Forest Service 2012b) and the Soil and Water Conservation Handbook (R1/R4 Amendment) (USDA Forest Service 1988c) as shown in Table O-3. BMPs are designed to avoid or minimize potential adverse effects to water quality.

Table O-3: Project Design Criteria Related specifically to Soil and Water, and linkage to specific BMPs.

Design Criteria	National Core BMP Reference	Soil & Water Conservation Handbook Practice
Design Criteria: General Herbicide Application	**National Core BMP Reference**	**Soil & Water Conservation Handbook Practice**
Always read and follow label directions, including instructions for herbicide use, application rates, equipment and techniques and personal protective equipment for applicators.	Chem-2	13.08
Make sure Material Safety Data Sheets, safety plans, spill prevention plan, and cleanup kits are available to applicators, per the requirements of FSH 2109.	Chem-1	13.10
Monitor wind speed and direction and equipment and spray parameters throughout an herbicide application. No herbicide shall be applied in sustained wind conditions exceeding five (5) miles per hour in riparian areas or in any wind conditions exceeding product label directions.	Chem-3	13.09 13.13
OHVs used to transport or spray herbicides are administratively allowed to travel off designated motorized routes. These vehicles would not be taken off designated routes if damage to soils could occur due to wet conditions. Take care to ensure that disturbance to desirable vegetation is minimized and that no visible "trail" creation occurs.	Road-4	
Follow the procedures in the SCNF Spill Plan in the event of a spill. Keep the SCNF Spill Plan compliant with NPDES.	Chem-3	13.10
To minimize herbicide drift during broadcast operations, use low pressure and larger droplet size to the extent possible with the equipment being used. Use nozzles designed for herbicide application.	Chem-1	13.13
Wherever possible, mix and load at a distance greater than 100 feet from water and where spilled materials will not flow into groundwater, wetlands or streams.	Chem-3 Chem-5	13.12
No broadcast application methods are used in riparian areas.	Plan-3 Chem-1 Chem-3	13.07 13.12
Design Criteria: Aerial Herbicide Application	**National Core BMP**	**Soil & Water Conservation Handbook Practice**
All live water (perennial streams, flowing intermittent streams, lakes, ponds, springs, and wetlands) would have a 300 foot "No Application" aerial herbicide buffer.	Plan-3 Chem-1 Chem-3	13.07 13.12 13.13
Aerial herbicide application would not occur in designated municipal watersheds. Idaho DEQ Source Protection Areas would not be included in aerial application project areas.	Chem-1	13.07 13.12

Design Criteria	National Core BMP Reference	Soil & Water Conservation Handbook Practice
Aerial herbicide application would not occur in Research Natural Areas (RNAs) or proposed wilderness areas. No aerial application would occur within ¼ mile of wild, scenic, and eligible rivers.	Chem-1	13.07
Aerial spray units (and perennial seeps, ponds, springs, and wetlands in proposed aerial units) would be ground-checked, flagged and marked using GPS prior to spraying to ensure only appropriate portions of the unit are aerially treated. A GPS system would be used in spray helicopters and each treatment unit mapped before the flight to ensure that only areas marked for treatment are treated. Plastic spray cards would be placed out to 300 feet from and perpendicular to perennial streams to monitor herbicide presence.	Chem-3	13.09 13.12 13.13
Aerial herbicide application would not occur when sustained wind speeds exceed 5 mph or label recommendations, whichever is less.	Chem-3	13.13
Aerial herbicide applications would not occur during inversions, or below minimum relative humidity or above maximum temperature, as stated on label.	Chem-3	13.13
Considerations for choosing sites for aerial application would include the extent of the weed infestation, the cumulative size of the infestation (many small sites in close relative proximity to each other), and the density of the invasive species.		13.07
Herbicide applicators would obtain a weather forecast for the area prior to initiating a spraying project to ensure no extreme precipitation or wind events were predicted to occur during or immediately after spraying that could allow runoff or drift into waterbodies.	Chem-3	13.12 13.13
The Aerial Herbicide Application Coordination and Safety Implementation Plan would be followed.	Chem-1 Chem-3	13.10
Aquatic applications would not be applied aerially.	Chem-4	
When the product label recommends use of an adjuvant, only aquatic-approved adjuvant may be used.	Chem-4	13.08
Conduct evaluation of the infested site to determine best control method, including (a) location, number and extent of infestations, (b) depth, flow, substrate, water quality and configuration of the water body involved, (c) density and diversity of native flora, and (d) direct and indirect effects to native flora and fauna and to people (e.g. domestic water use).	Chem-4	13.07 13.12
Consider whether to apply herbicide to entire body of water, or to areas with highest risk as vectors, such as boat ramps.	Chem-4	13.07
Use label to determine what proportion of water body may be treated at one time without causing excessive oxygen depletion from decaying plant matter.	Chem-2 Chem-4	13.08
Do not apply to water where weeds are not present if herbicide is not labeled for submerged vegetation. Prefer spot-spraying techniques when applying herbicides to emergent vegetation.	Chem-4	13.08

Design Criteria	National Core BMP Reference	Soil & Water Conservation Handbook Practice
In the event of a detection of an aquatic nuisance plant species, the applicable sections of Idaho's Rapid Response Strategy will be followed from the Idaho Aquatic Nuisance Species Plan (Idaho Invasive Species Council Technical Committee, 2007).	Chem-1 Chem-4	
Design Criteria: Manual and Mechanical Treatment	**National Core BMP**	**Soil & Water Conservation Handbook Practice**
Minimize soil disturbance as much as possible to minimize germination of weed seeds and bare soil.	Veg-2 Veg-8	
Specific to aquatic noxious weeds, hand-pulling and/or smothering may be used when an infestation is very limited in extent and occurs close to the shoreline of a water body, but has not yet infested deeper waters.	-	
Design Criteria: Rehabilitation and Restoration	**National Core BMP**	**Soil & Water Conservation Handbook Practice**
Assess erosion processes that may be affecting the site and the degree of severity of any soil erosion.	Veg-2 Veg-8	
Minimize ground disturbing activities to the extent possible during reseeding efforts.	Veg-2 Veg-8	
Conduct rehabilitation and restoration activities only in areas with slope gradients less than 45%.	Veg-1 Veg-8	
Conduct rehabilitation and restoration activities only in areas with low or moderate landtype erosion hazard ratings.	Veg-1 Veg-8	

Appendix P: Noxious Plant Infestations and Cover Types

Table P-1: Known Noxious Plant Infestations within Sage-grouse potential vegetation types (PVT) Habitat

Weed Zones	Total Acres Sage Grouse PVT Habitat	Hoary Alyssum	Whitetop	Musk thistle	Diffuse Knapweed	Spotted Knapweed	Rush Skeletonweed	Oxeye Daisy	Canada Thistle	Houndstongue	Leafy Spurge	Black Henbane	Dalmatian Toadflax	Yellow Toadflax	Yellow Toadflax	Puncturevine	Grand Total
Lemhi Zone	109,453	0.3	7.9	335.3		1,107.0	0.1		133.3	33.6	69.7	27.0			6.6		1,721.1
North Zone	19,232	68.0		0.2		1,209.6	21.3	0.0	2.2	12.2	18.5	0.8	0.1	1.8	0.6	1.3	1,336.8
Pahsimeroi-Lost Zone	529,230		37.9	790.2	3.3	276.8	0.1		1,164.6		653.9	226.6	72.2	19.3			3,245.1
Salmon Zone	103,192	156.4	1.9	105.8	0.2	4,508.1	37.5	1.3	49.8	21.0	4.0	4.0	11.7	5.7	13.6		4,921.2
Upper Salmon Zone	184,822			7.6		764.3	44.9	45.1	53.1	5.2	0.1			98.3	2.3		1,021.1
Grand Total	**945,929**	**224.7**	**47.8**	**1,239.1**	**3.5**	**7,865.8**	**103.9**	**46.5**	**1,403.0**	**72.0**	**746.2**	**258.5**	**84.0**	**125.2**	**23.2**	**1.3**	**12,245.4**

Infestations < 1 acre: Russian Knapweed (0.1), Field Bindweed (0.2), Common St. John's wort (0.1), Perennial Pepperweed (0.2), and Tamarisk (0.1)

Table P-2: Known Infestations of Noxious Invasive Plants in the Salmon-Challis National Forest

Plant Code	Common Name	Lemhi Zone	North Zone	Pahsimeroi-Lost Zone	Salmon Zone	Upper Salmon Zone	Grand Total
ACRE3	Russian Knapweed		0.1	0.1			0.2
BEIN2	Hoary Alyssum	0.5	1,078.5		1,097.4	0.0	2,176.4
CADR	Whitetop	9.1	0.3	38.2	2.2		49.8
CANU4	Musk thistle	629.6	22.6	932.1	178.4	19.4	1,782.2
CEDI3	Diffuse Knapweed		0.2	4.0	0.2	0.1	4.5
CEMA4	Spotted Knapweed	1,733.2	21,460.3	405.2	14,237.4	1,369.2	39,205.2
CHJU	Rush Skeletonweed	0.2	137.7	1.6	110.7	95.4	345.6
CHLE80	Oxeye Daisy		120.3		3.7	94.6	218.7
CIAR4	Canada Thistle	316.6	112.9	1,898.4	216.2	98.2	2,642.3
COAR4	Field Bindweed			0.2		0.4	0.6
CYOF	Houndstongue	71.7	592.4	0.9	122.9	7.2	795.1
EUES	Leafy Spurge	76.4	75.5	695.0	16.4	1.9	865.2
HYNI	Black Henbane	30.9	12.1	236.4	5.0		284.4

Plant Code	Common Name	Lemhi Zone	North Zone	Pahsimeroi-Lost Zone	Salmon Zone	Upper Salmon Zone	Grand Total
HYPE	Common St. Johnswort		2.5				2.5
ISTI	Dyer's Woad		0.0				0.0
LELA2	Perennial Pepperweed	0.2					0.2
LIGED	Dalmatian Toadflax		0.2	81.9	41.0		123.1
LIVU2	Yellow Toadflax		37.9	35.1	18.8	281.7	373.5
ONAC	Scotch Thistle	0.2					0.2
POLYG4	Knotweed		0.9				0.9
PORE5	Sulphur Cinquefoil	10.3	222.8		42.5	2.9	278.6
TARA	Saltcedar		0.1		0.4		0.5
TRTE	Puncturevine		3.5		0.1		3.6
Total Acres		**2,879.0**	**23,880.9**	**4,329.1**	**16,093.2**	**1,971.0**	**49,153.2**

Table P-3: Known Noxious Plant Infestations within Modeled Wolverine Habitat

Weed Zones	Weed Zone Acres	Hoary Alyssum	Musk thistle	Spotted Knapweed	Canada Thistle	Hounds-tongue	Leafy Spurge	Yellow Toadflax	Total Acres
Lemhi Zone	91,091		110.5	250.6	50.6		0.1		412.2
North Zone	74,254	0.6		233.5	0.5	1.8			236.4
Pahsimeroi-Lost Zone	138,721		74.2	51.4	400.9	0.9	3.2		530.7
Salmon Zone	221,635	8.0	43.4	595.6	10.9	22.2		0.2	681.6
Upper Salmon Zone	232,208		1.9	90.8	0.0		0.1	2.2	95.1
Grand Total	**757,908**	**8.6**	**229.9**	**1,221.8**	**462.9**	**24.9**	**3.4**	**2.4**	**1,956.0**

< 1 acre: whitetop (0.1); rush skeletonweed (0.5); oxeye daisy (0.9); black henbane (0.1); Dalmatian toadflax (0.1); Scotch thistle (0.2); sulphur cinquefoil (0.1)

Table P-4: Known Noxious Plant Infestations within Pygmy Rabbit Potential PVT Habitat

Cover Type by Invasive Plant Management Zone Labels	Total Number of Acres of Cover Type	Hoary Alyssum	Whitetop	Musk thistle	Diffuse Knapweed	Spotted Knapweed	Rush Skeletonweed	Oxeye Daisy	Canada Thistle	Houndstongue	Leafy Spurge	Black Henbane	Dalmatian Toadflax	Yellow Toadflax	Sulphur Cinquefoil	Saltcedar	Puncturevine	Total Acres
Lemhi Zone	**23,434**	**0.3**	**7.9**	**335.3**		**1,107.0**	**0.1**		**133.3**	**33.6**	**69.7**	**27.0**			**6.6**			**1,721.1**
Mountain Big Sage	18,468	0.2	5.8	39.0		184.7			16.7	0.9	19.0	8.9			1.3			276.6
Wyoming Big Sage	4,966	0.0	0.0	49.5		264.6			6.5	20.0	26.4	1.5			0.2			368.6
North Zone	**3,904**	**68.0**		**0.2**		**1,209.6**	**21.3**	**0.0**	**2.2**	**12.2**	**18.5**	**0.8**	**0.1**	**1.8**	**0.6**		**1.3**	**1,336.8**
Mountain Big Sage	1,128					19.0												19.0
Wyoming Big Sage	2,777	3.4		0.0		150.4			2.1	4.0	2.9			0.1	0.0			162.9
Pahsimeroi-Lost Zone	**220,822**		**37.9**	**790.2**	**3.3**	**276.8**	**0.1**		**1,164.6**		**653.9**	**226.6**	**72.2**	**19.3**				**3,245.1**
Mountain Big Sage	162,003		34.5	285.5	1.7	121.4			565.1		283.1	62.3	34.9	19.3				1,407.9
Wyoming Big Sage	58,819		1.3	79.9	1.3	61.5			60.1		241.0	89.3	17.2					551.8
Salmon Zone	**27,887**	**156.4**	**1.9**	**105.8**	**0.2**	**4,508.1**	**37.5**	**1.3**	**49.8**	**21.0**	**4.0**	**4.0**	**11.7**	**5.7**	**13.6**	**0.2**		**4,921.2**
Mountain Big Sage	16,480	31.9	0.2	43.0		643.1	1.7		6.4	8.1	0.3	1.7	0.1	0.3	0.5			737.5
Wyoming Big Sage	11,406	37.1	0.7	20.0		1,271.4	14.8	0.1	15.4		1.6	0.7		0.0	3.7			1,365.5
Upper Salmon Zone	**67,048**			**7.6**		**764.3**	**44.9**	**45.1**	**53.1**	**5.2**	**0.1**			**98.3**	**2.3**			**1,021.1**
Mountain Big Sage	44,422			5.8		346.6	7.8	7.8	6.4	0.5				12.1	0.0			387.1
Wyoming Big Sage	22,626					174.5	18.1	18.1	33.9	1.6				31.2				277.3

Cover Type by Invasive Plant Management Zone Labels	Total Number of Acres of Cover Type	Hoary Alyssum	Whitetop	Musk thistle	Diffuse Knapweed	Spotted Knapweed	Rush Skeletonweed	Oxeye Daisy	Canada Thistle	Houndstongue	Leafy Spurge	Black Henbane	Dalmatian Toadflax	Yellow Toadflax	Sulphur Cinquefoil	Saltcedar	Puncturevine	Total Acres
Total Acres	**343,095**	**224.7**	**47.8**	**1,239.1**	**3.5**	**7,865.8**	**103.9**	**46.5**	**1,403.0**	**72.0**	**746.2**	**258.5**	**84.0**	**125.2**	**23.2**	**0.2**	**1.3**	**12,245.4**

Infestations < 1 acre: Russian knapweed (0.1), field bindweed (0.2), and perennial pepperweed (0.2)

Table P-5: Known Noxious Plant Infestations within Modeled Bighorn Sheep Habitat

PMUs within Invasive Plant Management Zones	Total Modeled Acres	Hoary Alyssum	Hoary Cress	Musk thistle	Spotted Knapweed	rush skeletonweed	Ox-eye Daisy	Canada Thistle	Houndstongue	Leafy Spurge	Black Henbane	Dalmatian Toadflax	Yellow Toadflax	Sulphur Cinquefoil	Puncturevine	Total Acres
Lemhi Zone	**105,881**		**0.2**	**235.9**	**275.8**			**96.5**	**71.6**	**72.0**	**16.3**					**768.4**
Not in PMU	5,395															
North Beaverhead	94,035		0.2	235.9	275.8			96.5	71.6	72.0	16.3					768.4
North Lemhi	6,451															
North Zone	**238,566**	**599.3**	**0.2**	**5.9**	**11,815.5**	**137.3**	**0.6**	**37.0**	**199.6**	**25.7**	**2.0**	**0.1**	**23.1**	**75.4**	**3.5**	**12,926.4**
Lower Panther-Main Salmon	231,059	543.3		0.5	11,278.6	136.8	0.4	7.0	148.1	25.7	0.3	0.1	23.1	71.9	3.5	12,240.6
Middle Fork Salmon River	8				0.4											0.4
Tower-Kriley	7,499	56.0	0.2	5.3	536.5	0.5	0.1	30.0	51.6		1.7		0.0	3.5		685.4
Pahsimeroi-Lost Zone	**869,531**		**36.1**	**871.9**	**306.4**	**0.1**		**1,223.6**	**0.9**	**601.9**	**163.5**	**81.9**	**35.1**			**3,325.5**
Not in PMU	11,788															
East Fork Salmon River	230															
Lost River	321,780		0.2	741.3	100.9			811.3	0.9	86.6	67.8		35.1			1,844.2
North Lemhi	68,231			40.5	52.2	0.1		0.1		10.1		81.7				184.9
Pioneers	388,066		35.9	90.1	149.3			411.9		501.2	95.7	0.3				1,288.2
South Lemhi	79,436				4.0			0.3		4.0						8.2
Salmon Zone	**289,816**	**989.5**	**0.3**	**30.6**	**8,441.5**	**81.5**	**0.5**	**105.1**	**0.7**	**0.3**	**0.2**	**40.9**	**8.9**	**35.5**	**0.1**	**9,736.1**

PMUs within Invasive Plant Management Zones	Total Modeled Acres	Hoary Alyssum	Hoary Cress	Musk thistle	Spotted Knapweed	rush skeletonweed	Ox-eye Daisy	Canada Thistle	Houndstongue	Leafy Spurge	Black Henbane	Dalmatian Toadflax	Yellow Toadflax	Sulphur Cinquefoil	Puncturevine	Total Acres
Not in PMU	213															
Lower Panther-Main Salmon	76,899	735.6	0.0	0.1	4,851.7	80.6		7.6	0.2					31.1	0.1	5,707.2
Middle Fork Salmon River	70,093	231.6			1,101.5	0.6	0.5	0.4	0.2	0.3	0.1	40.9	8.8	0.1		1,385.1
Middle Main Salmon River	101,041	22.2	0.3	0.1	2,098.8	0.3		7.8	0.3				0.1			2,130.2
North Lemhi	41,570			30.4	389.5			89.2			0.1			4.4		513.5
Upper Salmon Zone	**437,002**	**0.0**		**19.4**	**1,075.3**	**0.3**	**0.0**	**86.2**	**7.2**	**1.9**			**145.5**	**2.6**		**1,338.8**
East Fork Salmon River	87,476				11.7			0.4								12.0
Lost River	33,058				33.4											33.4
Middle Fork Salmon River	90,312	0.0		2.1	118.3	0.2	0.0			1.6			20.3	0.3		143.2
Middle Main Salmon River	226,020			17.3	912.1	0.1		85.8	7.2	0.2			125.2	2.3		1,150.2
Pioneers	136															
Total Acres	**1,940,796**	**1,588.8**	**36.8**	**1,163.6**	**21,914.6**	**219.2**	**1.1**	**1,548.4**	**280.0**	**701.9**	**182.0**	**123.0**	**212.6**	**113.5**	**3.6**	**28,095.3**

Infestations < 1 acre: Russian knapweed (0.2), field bindweed (0.4), common St. Johnswort (0.1), knotweed (0.9), and tamarisk (0.5)

Table P-5: Riparian Cover Types

Cover Types	Lemhi Zone	North Zone	Pahsimeroi-Lost Zone	Salmon Zone	Upper Salmon Zone	Total Acres
Aspen	2,030.9	228.1	5,185.7	1,526.7	2,772.1	11,743.4
Conifer/Aspen	849.6	269.3	5,561.4	520.1	951.9	8,152.4
Conifer/Cottonwood	120.5	858.2	313.8	823.6	57.9	2,173.9
Cottonwood	88.6	1,345.0	386.9	863.3	68.4	2,752.3
Cottonwood/Conifer	54.2	69.2	77.6	130.5	22.7	354.1
Riparian Shrub	1,062.3	684.5	2,288.0	1,187.2	3,880.7	9,102.7
Water	320.7	385.3	323.1	552.7	355.2	1,937.0
Total Acres	**4,526.8**	**3,839.6**	**14,136.5**	**5,604.0**	**8,109.0**	**36,215.8**

Table P-6: Known Noxious Plant Infestations within Riparian PVT

Cover Types	Hoary Alyssum	Musk Thistle	Spotted Knapweed	Rush Skeletonweed	Oxeye Daisy	Canada Thistle	Houndstongue	Leafy Spurge	Black Henbane	Dalmatian Toadflax	Yellow Toadflax	Sulphur Cinquefoil	Grand Total
Lemhi Zone													**299.9**
Aspen		27.2	33.7			25.4	0.9	0.0	0.5			0.2	87.9
Conifer/Aspen		11.5	13.9			4.7		0.1	0.9				31.0
Conifer/Cottonwood		1.0	20.6			4.1	4.0	0.2				0.7	30.6
Cottonwood		3.9	8.2			0.8	1.0					0.0	13.9
Cottonwood/Conifer		6.2	6.8				4.6						17.9
Riparian Shrub		31.0	39.2			32.3	11.0		0.7			0.8	115.2
Water		0.7	1.8			0.9							3.4
North Zone													**254.5**
Aspen	0.3		15.8										16.1
Conifer/Aspen	0.7		1.4										2.2
Conifer/Cottonwood	0.7		43.3		0.0		2.1					5.7	51.9
Cottonwood	15.0		50.2	0.0	0.3	7.2	2.0	6.1	0.1		5.4	6.7	93.0
Riparian Shrub	3.4		43.6		0.3	0.2	0.0	4.7	0.1		4.4	0.8	57.5
Water	0.9	0.0	27.7	0.2	0.0	0.1		2.8			2.1		33.8
Pahsimeroi-Lost Zone													**261.2**
Aspen		7.8	16.4			37.5		4.8	0.1		1.5		68.8
Conifer/Aspen		4.0	8.8	0.1		28.4		8.8	0.8		1.2		52.1
Conifer/Cottonwood			0.0			0.6				0.6			1.2
Cottonwood		6.4	14.1			14.1		2.7		4.0	11.5		52.8
Cottonwood/Conifer		2.8				6.4			0.1				9.4
Riparian Shrub		8.0	20.9			29.3		7.0	3.7	1.3	1.5		71.7
Water			0.1			5.2							5.3
Salmon Zone													**636.6**
Aspen	0.6		50.5			7.3						1.0	59.5
Conifer/Aspen			12.9								0.1		13.0
Conifer/Cottonwood	24.4	0.0	139.3		0.0	10.4	0.3	0.5		2.3	0.4	0.7	178.2

Cover Types	Hoary Alyssum	Musk Thistle	Spotted Knapweed	Rush Skeletonweed	Oxeye Daisy	Canada Thistle	Houndstongue	Leafy Spurge	Black Henbane	Dalmatian Toadflax	Yellow Toadflax	Sulphur Cinquefoil	Grand Total
Cottonwood	4.2	1.3	137.1	0.0		39.9	0.1	0.8			0.4	4.0	187.8
Cottonwood/Conifer			13.7					0.0	0.1				13.8
Riparian Shrub	28.2	5.9	131.6			10.6		0.0		2.0	0.2		178.5
Water	0.5		4.9					0.4	0.0				5.8
Upper Salmon Zone													**121.8**
Aspen			25.4	0.2	0.2	0.1					0.4	0.0	26.3
Conifer/Aspen		0.4	1.0			0.0					0.0		1.4
Conifer/Cottonwood			7.9	2.2	2.2	1.0					3.6		16.9
Cottonwood			3.7	1.6	1.6	0.3					2.1		9.2
Cottonwood/Conifer			1.8										1.8
Riparian Shrub		0.2	56.5	0.7	0.7	1.9	0.2				4.9		65.2
Water			0.9								0.1		0.9
Total Acres	**79.0**	**118.3**	**953.9**	**5.0**	**5.3**	**268.7**	**26.3**	**38.9**	**7.0**	**10.2**	**39.8**	**20.6**	**3,148.0**

< 5 acres: Russian Knapweed (0); Whitetop (0.3); Diffuse Knapweed (0.8); Field Bindweed (0); Common St. Johnswort (0.1); Dyer's Woad (0); Perennial Pepperweed (0); Scotch Thistle (0); Knotweed (0); Saltcedar (0); Puncturevine (0)

Table P-7: Known Noxious Plant Infestations within Lynx Analysis Units

LAUs by Weed Zone	LAU Acres	Hoary Alyssum	Musk thistle	Diffuse Knapweed	Spotted Knapweed	Ox-eye Daisy	Canada Thistle	Hounds-tongue	Leafy Spurge	Yellow Toadflax	Total
Lemhi Zone	**32,411**		**14.2**		**74.3**		**12.1**				**100.6**
Big Eightmile	14,261		7.8		32.0						39.8
Hayden Basin	18,150		6.4		42.3		12.1				60.8
North Zone	**130,822**	**3.7**	**0.1**	**0.1**	**486.3**	**0.2**	**0.2**	**4.8**	**0.1**		**495.4**
Beartrap Ridge	28,638				32.1						32.1
Haystack Mountain	5,101	3.7			34.5						38.2

LAUs by Weed Zone	LAU Acres	Hoary Alyssum	Musk thistle	Diffuse Knapweed	Spotted Knapweed	Ox-eye Daisy	Canada Thistle	Hounds-tongue	Leafy Spurge	Yellow Toadflax	Total
Long Tom Ridge	37,851		0.1		191.8				0.1		192.0
North Fork Headwaters	34,195			0.1	190.2	0.2	0.2	4.8			195.5
Sheep Mountain	25,037				37.7						37.7
Salmon Zone	**154,487**	**45.1**	**8.0**		**421.4**	**0.2**	**0.1**			**0.3**	**475.2**
Black Mountain	14,757				36.8	0.2	0.0			0.3	37.3
Blackbird Mountain	18,383				27.1						27.1
Haystack Mountain	37,228	45.1			206.4						251.5
Lake Mountain	31,886				135.2						135.2
Phelan Mountain	32,446		8.0		1.3		0.1				9.5
Taylor Mountain	19,788				14.7		0.0				14.7
Upper Salmon Zone	**73,474**				**62.8**		**4.5**			**0.2**	**67.5**
Lower Beaver Creek	6,615				0.1						0.1
Seafoam	17,736				0.3						0.3
Squaw/Mill	33,521				61.4					0.1	61.6
Taylor Mountain	2,500				0.9					0.1	1.0
Upper Beaver Creek	13,102				0.1		4.5				4.6
Total	**391,194**	**48.8**	**22.3**	**0.1**	**1,044.9**	**0.4**	**16.9**	**4.8**	**0.1**	**0.5**	**1,138.8**

Table P-8:All Cover Types by Invasive Plant management Zone

Cover Type	Lemhi Zone	North Zone	Pahsimeroi-Lost Zone	Salmon Zone	Upper Salmon Zone	Grand Total
Aspen	2,030.9	228.1	5,185.7	1,526.7	2,772.1	11,743.4
Barren	48,604.0	13,170.4	238,330.6	23,750.6	48,273.1	372,128.7
Black Sage	128.5		12,797.3		1,600.6	14,526.5
Bunchgrass	830.5	6,143.7	15,599.0	5,874.5	5,211.3	33,658.9
Bunchgrass/Fescue	24,012.8	40,647.7	50,468.8	48,016.9	33,234.7	196,381.1
Conifer/Aspen	849.6	269.3	5,561.4	520.1	951.9	8,152.4
Conifer/Cottonwood	120.5	858.2	313.8	823.6	57.9	2,173.9
Conifer/Fescue	1,184.0	934.8	2,445.6	1,425.2	6,316.9	12,306.6
Conifer/Mountain Big Sage	18,551.1	2,164.3	106,224.8	18,012.0	40,325.9	185,278.0
Cottonwood	88.6	1,345.0	386.9	863.3	68.4	2,752.3

Cover Type	Lemhi Zone	North Zone	Pahsimeroi-Lost Zone	Salmon Zone	Upper Salmon Zone	Grand Total
Cottonwood/Conifer	54.2	69.2	77.6	130.5	22.7	354.1
Douglas-fir	72,017.7	146,625.5	175,499.6	214,526.4	193,945.3	802,614.5
Dry Shrub/Bunchgrass	593.6	6,810.5	9,937.1	4,691.4	1,080.8	23,113.4
Fescue	8,340.5	1,020.0	9,869.4	1,705.6	7,531.7	28,467.2
Fescue/Conifer	5,744.7	1,043.2	16,987.8	3,417.2	14,581.4	41,774.3
Grass/Forb	2,208.6	11,306.1	2,064.1	27,235.0	10,689.3	53,503.0
Grass/Sedge			2,394.3		23.6	2,417.9
Limber Pine	5,929.1		24,377.8		3,967.2	34,274.1
Lodgepole Pine	40,781.0	88,870.9	13,482.8	189,772.3	128,253.1	461,160.1
Low Sage			11,031.6		1,514.5	12,546.1
Moist Shrub	227.5	54.0	121.2	273.2	317.2	993.3
Mountain Big Sage	40,719.1	1,578.6	196,197.2	42,776.9	59,531.8	340,803.7
Mountain Big Sage/Fescue	2,084.4	152.8	22,873.4	866.9	1,819.0	27,796.5
Mountain Mahogany	67.2	1,035.7	21,003.7	718.4	1,636.6	24,461.6
No Data	16.5	1.9	19.0	2.1	2.0	41.5
Pasture/Agricultural	146.5	225.3	1,317.0	147.1	281.9	2,117.7
Ponderosa Pine		59,340.7		13,061.6	528.1	72,930.4
Riparian Shrub	1,062.3	684.5	2,288.0	1,187.2	3,880.7	9,102.7
Sand Dropseed			290.4		0.1	290.4
Shadscale			553.6			553.6
Spruce/Fir	19,557.7	27,342.2	26,162.6	34,539.3	33,123.7	140,725.5
Threetip Sage	4,853.9	821.6	664.2	2,991.5	4,991.6	14,322.8
Unknown	2,654.2	113.2	2,899.7	889.4	1,096.9	7,653.2
Water	320.7	385.3	323.1	552.7	355.2	1,937.0
Whitebark Pine	16,466.2	3,558.4	26,902.6	10,729.3	24,091.9	81,748.4
Wyoming Big Sage	4,195.8	1,418.4	54,383.5	7,590.7	18,682.2	86,270.6
Total Acres	**324,441.7**	**418,219.5**	**1,059,035.4**	**658,617.5**	**650,761.7**	**3,111,075.7**

Table P-9: Known Noxious Plant Infestations within All Cover Types

Cover Types	Hoary Alyssum	Whitetop	Musk Thistle	Spotted Knapweed	Rush Skeletonweed	Oxeye Daisy	Canada Thistle	Houndstongue	Leafy Spurge	Black Henbane	Dalmatian Toadflax	Yellow Toadflax	Sulphur Cinquefoil	Total Acres
Lemhi Zone	0.5	9.1	622.9	1,728.3	0.2		316.6	71.7	76.4	30.9			10.3	2,867.4
Aspen			27.2	33.7			25.4	0.9	0.0	0.5			0.2	87.9
Barren			1.4	16.6			0.8	0.2	3.4					22.4
Black Sage			13.1	5.0			1.7	2.5	3.6					26.0
Bunchgrass			6.3	37.0			2.0	0.3	1.8					47.3
Bunchgrass/Fescue			26.9	120.9			15.5		8.5	10.4			0.9	183.2
Conifer/Aspen			11.5	13.9			4.7		0.1	0.9				31.0
Conifer/Cottonwood			1.0	20.6			4.1	4.0	0.2				0.7	30.6
Conifer/Mountain Big Sage		1.8	74.1	208.3			43.8	6.9	14.1	0.7			3.4	353.2
Cottonwood			3.9	8.2			0.8	1.0					0.0	13.9
Cottonwood/Conifer		0.2	6.2	6.8				4.6						17.9
Douglas-fir	0.1	1.0	135.5	296.4	0.1		55.6	1.2	2.6	1.1			1.8	495.4
Dry Shrub/Bunchgrass	0.0		3.3	13.5			0.1	2.7	2.4					21.9
Fescue				0.3										0.3
Fescue/Conifer				1.4										1.4
Grass/Forb			1.3	3.1			0.5			0.2				5.1
Limber Pine				23.1					0.3					23.3
Lodgepole Pine			26.1	76.8			21.3							124.4
Moist Shrub			7.0	5.0			1.0							13.0
Mountain Big Sage	0.2	5.8	138.1	373.5			56.1	1.2	12.8	12.3			2.2	602.2
Pasture/Agricultural				0.1										0.1
Riparian Shrub		0.0	31.0	39.2			32.3	11.0		0.7			0.8	115.2
Spruce/Fir	0.0		23.1	52.7			27.3	10.5	0.0	0.3			0.2	114.2
Threetip Sage	0.1	0.3	27.7	120.8	0.1		7.8	0.2	1.9	2.2				161.0
Unknown			11.8	21.5			8.7	4.6	0.1	0.2				46.7
Water			0.7	1.8			0.9							3.4

Cover Types	Hoary Alyssum	Whitetop	Musk Thistle	Spotted Knapweed	Rush Skeletonweed	Oxeye Daisy	Canada Thistle	Houndstongue	Leafy Spurge	Black Henbane	Dalmatian Toadflax	Yellow Toadflax	Sulphur Cinquefoil	Total Acres
Whitebark Pine				0.4										0.4
Wyoming Big Sage	0.0	0.0	45.8	227.9			6.4	19.9	24.6	1.5			0.2	326.1
North Zone	1,077.7	0.3	22.6	21,460.0	137.7	120.3	112.9	592.4	75.5	12.1	0.2	37.9	222.8	23,879.9
Aspen	0.3			15.8										16.1
Barren	24.8		0.5	405.5	11.1			3.4	1.4	0.0		2.5	15.5	465.1
Bunchgrass	18.4			506.3	19.2		0.0	1.6	0.7	0.1		0.1	0.3	548.0
Bunchgrass/Fescue	218.6	0.3	4.5	4,713.3	73.1	4.3	51.1	136.5	17.3	3.2		13.0	31.0	5,266.7
Conifer/Aspen	0.7			1.4										2.2
Conifer/Cottonwood	0.7			43.3		0.0		2.1					5.7	51.9
Conifer/Fescue				10.7										10.7
Conifer/Mountain Big Sage	2.2		0.1	56.4				0.2		0.3			0.2	59.4
Cottonwood	15.0			50.2	0.0	0.3	7.2	2.0	6.1	0.1		5.4	6.7	93.0
Douglas-fir	282.2		5.6	6,228.2	1.0	33.6	13.7	193.9	5.4	0.9	0.1	1.1	46.5	6,813.1
Dry Shrub/Bunchgrass	29.0		0.2	1,171.2	6.6		10.3	6.3	0.1	0.3		0.3	1.6	1,226.1
Fescue				3.8			0.1							3.9
Fescue/Conifer	4.3			12.7										17.0
Grass/Forb				111.8					0.1					111.9
Lodgepole Pine	40.5		0.7	922.5		4.9	2.0	23.9						994.6
Mountain Big Sage				48.2										48.2
Mountain Mahogany	27.7		0.1	188.3	1.7	0.0		1.7	1.4	0.1	0.1	1.6	0.0	222.8
Pasture/Agricultural	0.2			0.2										0.4
Ponderosa Pine	403.1		10.9	6,682.7	24.9	76.9	25.6	210.5	19.1	7.0		7.4	114.3	7,586.5
Riparian Shrub	3.4			43.6		0.3	0.2	0.0	4.7	0.1		4.4	0.8	57.5
Spruce/Fir	2.8			136.3			0.5	1.8					0.1	141.5
Threetip Sage	0.0			49.0			0.1	4.9	13.6				0.1	67.7
Water	0.9		0.0	27.7	0.2	0.0	0.1		2.8			2.1		33.8
Whitebark Pine				6.2										6.2

Cover Types	Hoary Alyssum	Whitetop	Musk Thistle	Spotted Knapweed	Rush Skeletonweed	Oxeye Daisy	Canada Thistle	Houndstongue	Leafy Spurge	Black Henbane	Dalmatian Toadflax	Yellow Toadflax	Sulphur Cinquefoil	Total Acres
Wyoming Big Sage	2.9		0.0	24.5			2.0	3.5	2.8					35.7
Pahsimeroi-Lost Zone		38.2	932.1	405.2	0.3		1,894.4	0.9	695.0	236.4	81.9	35.1		4,323.8
Aspen			7.8	16.4			37.5		4.8	0.1		1.5		68.8
Barren			7.2				21.5		3.0	0.9				32.6
Black Sage		1.7	168.3	8.7	0.1		170.6		27.9	10.7				388.0
Bunchgrass		0.3	83.3	3.2			48.4		19.8	10.8				165.9
Bunchgrass/Fescue			73.0	63.5			92.3		20.1	16.6	0.8	3.3		269.6
Conifer/Aspen			4.0	8.8	0.1		28.4		8.8	0.8		1.2		52.1
Conifer/Cottonwood				0.0			0.6				0.6			1.2
Conifer/Mountain Big Sage		0.0	44.3	28.4			123.6		28.0	0.6	7.5			232.4
Cottonwood			6.4	14.1			14.1		2.7		4.0	11.5		52.8
Cottonwood/Conifer			2.8				6.4			0.1				9.4
Douglas-fir		0.1	87.9	49.6			433.1	0.9	3.2	1.3	3.7			579.7
Dry Shrub/Bunchgrass				3.4			0.1		15.7	0.4	0.3			19.8
Fescue			0.1											0.1
Grass/Forb			0.2				5.8							6.0
Grass/Sedge		0.2	4.5	5.2			10.3		3.0	0.3				23.4
Limber Pine							3.9							3.9
Lodgepole Pine				0.0			20.4							20.4
Low Sage		0.3	26.6	4.0			23.1		12.3	48.5				114.8
Moist Shrub			0.2	0.3			8.8							9.4
Mountain Big Sage		34.5	241.5	83.7	0.0		615.5		302.0	47.4	42.2	16.0		1,384.9
Mountain Mahogany			77.0	0.1			12.2		1.6					90.9
Pasture/Agricultural			0.1				0.0		1.9					2.1
Riparian Shrub			8.0	20.9			29.3		7.0	3.7	1.3	1.5		71.7

Cover Types	Hoary Alyssum	Whitetop	Musk Thistle	Spotted Knapweed	Rush Skeletonweed	Oxeye Daisy	Canada Thistle	Houndstongue	Leafy Spurge	Black Henbane	Dalmatian Toadflax	Yellow Toadflax	Sulphur Cinquefoil	Total Acres
Spruce/Fir			8.1	9.2			64.6		5.9	0.1	0.1			88.0
Threetip Sage			0.3	20.7			31.1			2.3	4.3			58.7
Unknown			4.8	3.7	0.0		31.7		0.8	2.6				43.5
Water				0.1			5.2							5.3
Wyoming Big Sage		1.2	75.9	61.1			56.0		226.3	89.3	17.2			528.3
Salmon Zone	1,097.4	2.2	178.4	14,237.4	110.7	3.7	216.2	122.9	16.4	5.0	41.0	18.8	42.5	16,093.2
Aspen	0.6	0.1		50.5			7.3						1.0	59.5
Barren	35.9			298.2	11.0		0.6		1.6	0.0		0.4	16.6	364.3
Bunchgrass	24.2	0.1	2.9	479.6	12.7	0.5	4.4		0.8	1.1			0.3	526.8
Bunchgrass/Fescue	253.1	0.2	7.5	2,201.8	36.1	0.7	3.7	10.4	1.0	1.0	6.9	1.1	8.4	2,531.9
Conifer/Aspen				12.9								0.1		13.0
Conifer/Cottonwood	24.4		0.0	139.3		0.0	10.4	0.3	0.5		2.3	0.4	0.7	178.2
Conifer/Fescue	5.4			21.9										27.3
Conifer/Mountain Big Sage	8.8	0.0	10.8	531.9	1.4		4.2	10.4	0.1			0.9	1.4	570.0
Cottonwood	4.2		1.3	137.1	0.0		39.9	0.1	0.8			0.4	4.0	187.8
Cottonwood/Conifer				13.7					0.0	0.1				13.8
Douglas-fir	328.1	0.2	47.1	4,356.6	12.3	1.7	70.0	66.1	8.4	0.8	9.0	8.0	5.8	4,913.9
Dry Shrub/Bunchgrass	9.7			413.3	11.5	0.0	0.0		1.1		8.1	0.4	0.1	444.2
Fescue	15.0			132.8		0.8								148.6
Fescue/Conifer	3.7			26.1										29.8
Grass/Forb				153.5		0.0	0.4							153.8
Lodgepole Pine	38.0		15.5	976.4	0.1	0.0	14.2	17.7				0.2		1,062.2
Moist Shrub				6.6				0.0	0.0					6.7
Mountain Big Sage	31.0	0.2	56.2	1,435.6	2.1		22.1	3.3	0.5	0.8	0.1	4.4	0.2	1,556.7
Mountain Mahogany	0.5			39.9	0.1						3.5			44.0
Ponderosa Pine	239.8	0.0	2.8	1,321.2	17.0		5.4	14.7	0.0	0.1	9.2	1.9	0.7	1,612.8

Cover Types	Hoary Alyssum	Whitetop	Musk Thistle	Spotted Knapweed	Rush Skeletonweed	Oxeye Daisy	Canada Thistle	Houndstongue	Leafy Spurge	Black Henbane	Dalmatian Toadflax	Yellow Toadflax	Sulphur Cinquefoil	Total Acres
Riparian Shrub	28.2		5.9	131.6			10.6		0.0		2.0	0.2		178.5
Spruce/Fir	0.6			180.8			3.4	0.0				0.4		185.2
Threetip Sage	12.4	0.8	10.0	152.6	0.4		6.5		0.4	0.7				183.8
Unknown				17.7			1.8							19.5
Water	0.5			4.9					0.4	0.0				5.8
Whitebark Pine				0.1										0.1
Wyoming Big Sage	33.3	0.5	18.3	1,000.9	6.1		11.3		0.9	0.5		0.0	3.4	1,075.2
Upper Salmon Zone	0.0		19.4	1,369.2	95.4	94.6	98.2	7.2	1.9			281.7	2.9	1,971.0
Aspen				25.4	0.2	0.2	0.1					0.4	0.0	26.3
Barren				7.7	1.9	1.9	0.3	0.3				9.2		21.2
Bunchgrass				80.4	10.8	10.8	16.3		0.1			20.3		138.6
Bunchgrass/Fescue			5.4	189.5	9.8	10.2	2.2	0.5	1.6			20.7	0.2	240.5
Conifer/Aspen			0.4	1.0			0.0					0.0		1.4
Conifer/Cottonwood				7.9	2.2	2.2	1.0					3.6		16.9
Conifer/Mountain Big Sage				121.2	8.6	8.5	11.7	2.9				18.4		171.4
Cottonwood				3.7	1.6	1.6	0.3					2.1		9.2
Cottonwood/Conifer				1.8										1.8
Douglas-fir			11.1	387.3	38.9	38.1	23.5	1.4	0.1			134.0	0.0	634.6
Dry Shrub/Bunchgrass	0.0			26.7	0.0			0.0					0.3	27.0
Fescue												3.4		3.4
Fescue/Conifer												10.2		10.2
Limber Pine												0.0		0.0
Lodgepole Pine				41.4	2.6	2.7	4.3					9.4		60.5
Moist Shrub				0.1										0.1
Mountain Big Sage			2.2	259.9	8.6	8.4	4.9	0.3				17.3	2.3	304.0
Mountain				0.6			0.6					0.0		1.3

Cover Types	Hoary Alyssum	Whitetop	Musk Thistle	Spotted Knapweed	Rush Skeletonweed	Oxeye Daisy	Canada Thistle	Houndstongue	Leafy Spurge	Black Henbane	Dalmatian Toadflax	Yellow Toadflax	Sulphur Cinquefoil	Total Acres
Mahogany														
Pasture/Agricultural			0.1	2.1			13.3	0.1				14.7		30.3
Ponderosa Pine				14.8	0.1									14.9
Riparian Shrub			0.2	56.5	0.7	0.7	1.9	0.2				4.9		65.2
Spruce/Fir				5.7	0.3	0.2						0.3		6.6
Threetip Sage				38.1	1.7	1.7						1.7		43.3
Unknown				2.2			0.2					0.1		2.4
Water				0.9								0.1		0.9
Wyoming Big Sage				94.1	7.3	7.3	17.6	1.6				10.9		138.8
Total Acres	**2,175.6**	**49.8**	**1,775.4**	**39,200.1**	**344.2**	**218.7**	**2,638.4**	**795.1**	**865.2**	**284.4**	**123.1**	**373.5**	**278.6**	**49,135.2**

< 5 acres: Russian Knapweed (0.2); Diffuse Knapweed (4.5); Field Bindweed (0.6); Common St. Johnswort (2.5); Dyer's Woad (0); Perennial Pepperweed (0.2); Scotch Thistle (0.2); Knotweed (0.9); Saltcedar (0.5); Puncturevine (3.6)

Table P-10: Conifer Cover Types

Cover Types	Lemhi Zone	North Zone	Pahsimeroi-Lost Zone	Salmon Zone	Upper Salmon Zone	Grand Total
Conifer/Fescue	1,184	935	2,446	1,425	6,317	12,307
Douglas-fir	72,018	146,626	175,500	214,526	193,945	802,614
Fescue/Conifer	5,745	1,043	16,988	3,417	14,581	41,774
Limber Pine	5,929		24,378		3,967	34,274
Lodgepole Pine	40,781	88,871	13,483	189,772	128,253	461,160
Ponderosa Pine		59,341		13,062	528	72,930
Spruce/Fir	19,558	27,342	26,163	34,539	33,124	140,725
Whitebark Pine	16,466	3,558	26,903	10,729	24,092	81,748
Grand Total	**161,680**	**327,716**	**285,859**	**467,471**	**404,808**	**1,647,534**

Table P-11: Known Noxious Plant Infestations within Conifer Cover Types

Cover Types	Hoary Alyssum	Musk thistle	Spotted Knapweed	Rush Skeletonweed	Oxeye Daisy	Canada Thistle	Houndstongue	Leafy Spurge	Black Henbane	Dalmatian Toadflax	Yellow Toadflax	Sulphur Cinquefoil	Total Acres
Lemhi Zone													
Douglas-fir	0.1	135.5	296.4	0.1		55.6	1.2	2.6	1.1			1.8	495.4
Fescue/Conifer			1.4										1.4
Limber Pine			23.1					0.3					23.3
Lodgepole Pine		26.1	76.8			21.3							124.4
Spruce/Fir	0.0	23.1	52.7			27.3	10.5	0.0	0.3			0.2	114.2
Whitebark Pine			0.4										0.4
North Zone													
Conifer/Fescue			10.7										10.7
Douglas-fir	282.2	5.6	6,228.2	1.0	33.6	13.7	193.9	5.4	0.9	0.1	1.1	46.5	6,813.1
Fescue/Conifer	4.3		12.7										17.0
Lodgepole Pine	40.5	0.7	922.5		4.9	2.0	23.9						994.6
Ponderosa Pine	403.1	10.9	6,682.7	24.9	76.9	25.6	210.5	19.1	7.0		7.4	114.3	7,586.5
Spruce/Fir	2.8		136.3			0.5	1.8					0.1	141.5
Whitebark Pine			6.2										6.2
Pahsimeroi-Lost Zone													
Douglas-fir		87.9	49.6			433.1	0.9	3.2	1.3	3.7			579.7
Limber Pine						3.9							3.9
Lodgepole Pine			0.0			20.4							20.4
Spruce/Fir		8.1	9.2			64.6		5.9	0.1	0.1			88.0
Salmon Zone													
Conifer/Fescue	5.4		21.9										27.3
Douglas-fir	328.1	47.1	4,356.6	12.3	1.7	70.0	66.1	8.4	0.8	9.0	8.0	5.8	4,913.9
Fescue/Conifer	3.7		26.1										29.8
Lodgepole Pine	38.0	15.5	976.4	0.1	0.0	14.2	17.7				0.2		1,062.2
Ponderosa Pine	239.8	2.8	1,321.2	17.0		5.4	14.7	0.0	0.1	9.2	1.9	0.7	1,612.8
Spruce/Fir	0.6		180.8			3.4	0.0				0.4		185.2
Whitebark Pine			0.1										0.1

Cover Types	Hoary Alyssum	Musk thistle	Spotted Knapweed	Rush Skeletonweed	Oxeye Daisy	Canada Thistle	Houndstongue	Leafy Spurge	Black Henbane	Dalmatian Toadflax	Yellow Toadflax	Sulphur Cinquefoil	Total Acres
Upper Salmon Zone													
Douglas-fir		11.1	387.3	38.9	38.1	23.5	1.4	0.1			134.0	0.0	634.6
Fescue/Conifer											10.2		10.2
Limber Pine											0.0		0.0
Lodgepole Pine			41.4	2.6	2.7	4.3					9.4		60.5
Ponderosa Pine			14.8	0.1									14.9
Spruce/Fir			5.7	0.3	0.2						0.3		6.6
Total Acres	**1,348.6**	**374.3**	**21,841.4**	**97.3**	**158.1**	**788.7**	**542.6**	**45.1**	**11.6**	**22.1**	**172.9**	**169.4**	**25,572.0**

Infestations < 5 acres: Russian Knapweed (0); Whitetop (1.3); Diffuse Knapweed (0.2); Field Bindweed (0.2); Common St. Johnswort (2.1); Dyer's Woad (0); Perennial Pepperweed (0); Scotch Thistle (0.2); Knotweed (0.9); Saltcedar (0.2); Puncturevine (1.8)

Table P-12: Known Noxious Plant Infestations within Seasonal Sage-grouse Habitat

Seasonal SAGR Habitat by Weed Mngmt Zone	Total Acres Seasonal Habitat	Hoary Alyssum	Whitetop	Musk thistle	Diffuse Knapweed	Spotted Knapweed	Canada Thistle	Houndstongue	Leafy Spurge	Black Henbane	Yellow Toadflax	Sulphur Cinquefoil	Grand Total
Lemhi Zone	44,715	0.2	6.5	134.3		496.8	56.2	0.1	5.7	22.7			722.6
Breeding,Summer/Early Fall Habitat	7,091		6.5	19.9		134.9	0.3						161.7
Breeding,Summer/Early Fall,Fall/Winter Habitat	636					87.4							87.4
Summer/Early Fall Habitat	36,647	0.2		114.2		274.2	55.9		5.7	22.5			472.9
Summer/Early Fall,Fall/Winter Habitat	341			0.1		0.3		0.1		0.2			0.8
North Zone	1,133	0.2		0.2		377.0		1.4	14.9	0.1		3.2	396.9
Summer/Early Fall Habitat	1,133	0.2		0.2		377.0		1.4	14.9	0.1		3.2	396.9

Seasonal SAGR Habitat by Weed Mngmt Zone	Total Acres Seasonal Habitat	Hoary Alyssum	Whitetop	Musk thistle	Diffuse Knapweed	Spotted Knapweed	Canada Thistle	Houndstongue	Leafy Spurge	Black Henbane	Yellow Toadflax	Sulphur Cinquefoil	Grand Total
Pahsimeroi-Lost Zone	213,798		36.2	315.6	3.9	119.7	655.1		567.5	131.7	34.8		1,864.7
Breeding Habitat	4,243		0.3	0.3		0.2	0.3		0.7	88.0			89.9
Breeding,Summer/Early Fall Habitat	139,022		35.9	37.3	3.9	59.3	235.9		529.9	0.2			902.7
Summer/Early Fall Habitat	70,532			277.9		60.2	418.8		36.9	43.4	34.8		872.1
Salmon Zone	12,492	4.3	1.7	37.1	0.2	838.4	95.7		0.2		3.4	2.1	983.1
Breeding,Summer/Early Fall Habitat	4,453	4.3	0.4	29.5	0.2	154.5	88.8					1.6	279.3
Summer/Early Fall Habitat	8,039		1.3	7.7		683.9	7.0		0.2		3.4	0.4	703.8
Upper Salmon Zone	32,486			2.4		275.9	0.2						278.5
Breeding,Summer/Early Fall Habitat	7,749			2.4		226.4	0.2						228.9
Summer/Early Fall Habitat	24,737					49.5							49.5
Grand Total	**304,625**	**4.6**	**44.4**	**489.6**	**4.1**	**2,107.8**	**807.2**	**1.5**	**588.3**	**154.5**	**38.2**	**5.2**	**4,245.8**

Infestations < 1 acre: Russian Knapweed (0.1), Rush Skeleton-weed (0.2), and Perennial Pepperweed (0.1)

Appendix Q: Wild and Scenic River Segments, Idaho Roadless Area Characteristics, and Research Natural Areas

Eligible Wild and Scenic River Segments and Characteristics for Outstandingly Remarkable Values

Table Q-1: Eligible Stream Segments

Stream	Potential Classification	Miles	Outstandingly Remarkable Values
Bear Valley Creek	Scenic	5.3	Recreation/Fisheries/Wildlife/Ecology
Camas Creek	Wild	11.0	Fish/Wildlife/Scenery/Recreation
East Fork Pahsimeroi	Scenic	6.9	Scenery /Geology
Fall Creek	Wild	8.2	Scenery
Kane Creek	Scenic	8.7	Scenery
Lake Creek	Recreation	8.7	Scenery / Recreation
Marsh Creek	Recreation	6.0	Scenery / Recreation / Fisheries
Panther Creek	Recreation	47.5	Scenery / Recreation / Geology/ Fisheries / Wildlife
Star Hope Creek	Recreation	9.9	Recreation / Geology
Star Hope Creek	Scenic	7.3	Scenery / Geology
West Fork Yankee Fk	Scenic	13.7	Scenery / Recreation / Fisheries
Loon Creek	Wild	20.5	Scenery / Recreation / Fisheries /Heritage
Loon Creek	Recreation	6.5	Scenery / Recreation /Geology/ Fisheries /Heritage
Warm Spring Creek	Wild	19.9	Scenery / Geology
Summit Creek	Wild	3.5	Scenery
Lower Cedar Creek	Wild	4.2	Geology
Wildhorse Creek	Scenic	6.8	Scenery /Geology
Pahsimeroi River	Scenic	1.5	Scenery
Pass Creek	Recreation	2.6	Scenery / Geology
East Fk Big Lost R.	Recreation	27.5	Scenery / Geology /Heritage
Mill Creek	Recreation	10.6	Recreation
Salmon River	Recreation	5.6	Recreation
Hayden Creek	Recreation	6.3	Recreation / Fisheries / Wildlife
Muldoon Creek	Scenic	10.4	Scenery
West Fk Camas Creek	Wild	4.5	Scenery
Marsh Creek	Wild	4.0	Scenery / Recreation / Fisheries
Yankee Fork River	Recreation	3.3	Recreation / Geology /Heritage
Yankee Fork River	Recreation	5.9	Recreation / Geology /Heritage
Yankee Fork River	Recreation	7.1	Recreation / Geology /Heritage
Soldier Creek	Wild	1.7	Scenery / Geology / Fisheries /Other
Muskeg Creek	Wild	2.1	Scenery / Geology / Fisheries
Rapid River	Wild	8.0	Fisheries
Camas Creek	Recreation	6.8	Scenery / Recreation / Fisheries
Bear Valley Creek	Recreation	4.4	Recreation / Fisheries / Wildlife /Other
Hayden Creek	Scenic	5.9	Recreation / Fisheries / Wildlife

*all or part of shaded stream segments may be within designated Wilderness

The following eligibility criteria are offered to foster greater consistency within the agency and with other federal river-administering agencies. They are intended to set minimum thresholds to establish Outstandingly Remarkable Values and are illustrative and not all-inclusive.

1. Scenery. The landscape elements of landform, vegetation, water, color, and related factors result in notable or exemplary visual features and/or attractions. When analyzing scenic values, additional factors such as seasonal variations in vegetation, scale of cultural modifications, and the length of time negative intrusions are viewed, may be considered. Scenery and visual attractions may be highly diverse over the majority of the river or river segment.

2. Recreation. Recreational opportunities are, or have the potential to be, popular enough to attract visitors from throughout or beyond the region of comparison or are unique or rare within the region. River-related opportunities include, but are not limited to, sightseeing, interpretation, wildlife observation, camping, photography, hiking, fishing, hunting, and boating. The river may provide settings for national or regional usage or competitive events.

3. Geology. The river, or the area within the river corridor, contains one or more examples of a geologic feature, process, or phenomenon that is unique or rare within the region of comparison. The feature(s) may be in an unusually active stage of development, represent a "textbook" example, and/or represent a unique or rare combination of geologic features (erosional, volcanic, glacial, or other geologic structures).

4. Fish. Fish values may be judged on the relative merits of either fish populations or habitat, or a combination of these river-related conditions.

a. Populations. The river is nationally or regionally an important producer of resident and/or anadromous fish species. Of particular significance is the presence of wild stocks and/or federal or state listed or candidate threatened, endangered, or sensitive species. Diversity of species is an important consideration and could, in itself, lead to a determination of outstandingly remarkable.

b. Habitat. The river provides exceptionally high quality habitat for fish species indigenous to the region of comparison. Of particular significance is habitat for wild stocks and/or federal or state listed or candidate threatened, endangered, or sensitive species. Diversity of habitats is an important consideration and could, in itself, lead to a determination of outstandingly remarkable.

5. Wildlife. Wildlife values may be judged on the relative merits of either terrestrial or aquatic wildlife populations or habitat, or a combination of these conditions.

a. Populations. The river, or area within the river corridor, contains nationally or regionally important populations of indigenous wildlife species. Of particular significance are species considered to be unique, and/or populations of federal or state listed or candidate threatened, endangered, or sensitive species. Diversity of species is an important consideration and could, in itself, lead to a determination of outstandingly remarkable.

b. Habitat. The river, or area within the river corridor, provides exceptionally high quality habitat for wildlife of national or regional significance, and/or may provide unique habitat or a critical link in habitat conditions for federal or state listed or candidate threatened, endangered, or sensitive species. Contiguous habitat conditions are such that the biological needs of the species are met. Diversity of habitat is an important consideration and could, in itself, lead to a determination of outstandingly remarkable.

6. Historic and Cultural. The river, or area within the river corridor, contains important evidence of occupation or use by humans. Sites may have national or regional importance for interpreting history or prehistory.

a. History. Site(s) or feature(s) associated with a significant event, an important person, or a cultural activity of the past that was rare or one-of-a-kind in the region. A historic site or feature, in most cases, is 50 years old or older.

b. Pre-history. Sites may have unique or rare characteristics or exceptional human interest value; represent an area where a culture or cultural period was first identified and described; may have been used concurrently by two or more cultural groups; or may have been used by cultural groups for rare sacred purposes.

7. Other Values. While no specific national evaluation guidelines have been developed for the "other similar values" category, assessments of additional river-related values consistent with the foregoing guidance may be developed, including, but not limited to, hydrology, paleontology, and botany resources.

Idaho Roadless Areas

Within the proposed project area 58 Idaho Roadless Areas (IRA) span approximately 2,265,513 acres. The majority of these IRAs fall within the 'Backcountry/Restoration' management theme of the Idaho Roadless Rule (1,720,624 acres) although 'Wild Land Recreation', 'Primitive', 'General Forest', and 'Special Areas' are also represented across the Forest. The table below lists the Idaho Roadless Areas for the project area and summarizes the acreage within each management theme by individual IRA.

Nine roadless characteristics (36 CFR 294.21) and six wilderness attributes used to evaluate IRAs and unroaded areas. The nine roadless characteristics are identified and described below, as are the six wilderness attributes. An in-depth description of each roadless area within the proposed project area and condition and character of each of the areas is further described in the FEIS for the Idaho Final Roadless Rule (2008).

Table Q-2: Idaho Roadless Areas Management Themes

Name	Management Theme	Total Acres
Agency	Total	6,389
	Backcountry Restoration	5,241
	General Forest	1,147
Allan Mountain	Total	46,478
	Backcountry Restoration	44,350
	Special Area	2,128
Anderson Mountain	Total	18,506
	Backcountry Restoration	18,506
Borah Peak	Total	130,463
	Backcountry Restoration	16,854
	Wild Land Recreation	109,253
	Special Area	4,356
Blue Bunch	Total	6,133
	Backcountry Restoration	6,133
Blue Joint Mountain	Total	480
	Primitive	480
Boulder-White Clouds	Total	139,296

Name	Management Theme	Total Acres
	Backcountry Restoration	23,444
	Wild Land Recreation	115,853
Camas Creek	Total	103,968
	Backcountry Restoration	103,968
Challis Creek	Total	44,319
	Backcountry Restoration	44,319
Cold Springs	Total	8,929
	Backcountry Restoration	8,929
Copper Basin	Total	10,945
	Backcountry Restoration	10,945
Deep Creek	Total	7,148
	General Forest	7,148
Diamond Peak	Total	78,654
	Backcountry Restoration	76,080
	Special Area	2,574
Duck Peak	Total	48,650
	Backcountry Restoration	47,298
	Special Area	1,352
Goat Mountain	Total	35,674
	Backcountry Restoration	35,674
Goldbug Ridge	Total	12,750
	Backcountry Restoration	12,750
Greylock	Total	11,825
	Backcountry Restoration	11,825
Grouse Peak	Total	8,953
	Backcountry Restoration	8,953
Hanson Lakes	Total	13,534
	Backcountry Restoration	13,534
Haystack Mtn	Total	12,122
	Backcountry Restoration	9,697
	General Forest	2,425
Italian Peak	Total	50,078
	Backcountry Restoration	50,078
Jesse Creek	Total	14,002
	Backcountry Restoration	14,002
Jumpoff Mountain	Total	14,449
	Backcountry Restoration	14,449
Jureano	Total	25,352
	Backcountry Restoration	21,032
	General Forest	4,320
King Mountain	Total	87,236
	Backcountry Restoration	87,236
Lemhi Range	Total	308,532
	Backcountry Restoration	305,198
	Special Area	3,334
Little Horse	Total	7,629
	Backcountry Restoration	7,629
Long Tom	Total	20,417
	Backcountry Restoration	18,558

Name	Management Theme	Total Acres
	Special Area	1,859
McEleny	Total	3,541
	Backcountry Restoration	3,541
Musgrove	Total	8,182
	Backcountry Restoration	7,222
	General Forest	960
Napias	Total	9,292
	General Forest	9,292
Napoleon Ridge	Total	51,426
	Backcountry Restoration	16,923
	General Forest	31,408
	Special Area	3,095
Oreana	Total	7,575
	Backcountry Restoration	7,575
Pahsimeroi Mountain	Total	73,428
	Backcountry Restoration	73,428
Perreau Creek	Total	8,168
	Backcountry Restoration	8,168
Phelan	Total	13,025
	General Forest	13,025
Pioneer Mountains	Total	172,459
	Backcountry Restoration	117,839
	Special Area	4,982
	Wildland Recreation	49,639
Pophyry	Total	46,597
	Backcountry Restoration	46,597
Railroad Ridge	Total	7,913
	Backcountry Restoration	7,913
Red Hill	Total	15,003
	Backcountry Restoration	15,003
Red Mountain	Total	4,897
	Backcountry Restoration	4,897
Sal Mountain	Total	13,974
	Backcountry Restoration	13,974
Seafoam	Total	31,066
	Backcountry Restoration	31,066
Sheepeater	Total	35,424
	Backcountry Restoration	24,413
	General Forest	9,079
	Special Area	1,931
South Deep Creek	Total	12,647
	Backcountry Restoration	7,796
	General Forest	4,851
South Panther	Total	6,338
	Backcountry Restoration	6,338
Spring Basin	Total	5,232
	Backcountry Restoration	5,232
Squaw Creek	Total	99,636
	Backcountry Restoration	99,636

Name	Management Theme	Total Acres
Taylor Mountain	Total	63,438
	Backcountry Restoration	63,438
Warm Creek	Total	6,636
	Backcountry Restoration	6,636
West Big Hole	Total	84,405
	Backcountry Restoration	51,403
	General Forest	9,574
	Primitive	20,526
	Special Area	2,902
West Panther Creek	Total	32,545
	Backcountry Restoration	32,545
White Knob	Total	65,705
	Backcountry Restoration	65,705
Wood Canyon	Total	7,754
	Backcountry Restoration	7,754
Total Acres Backcountry Restoration		1,839,909
Total Acres Primitive		21,006
Total Acres General Forest		101,399
Total Acres Special Area		28,513
Total Acres Wild Land Recreation		274,744
GRAND TOTAL		**2,265,571**

Roadless Area Characteristics

The following are roadless characteristics listed in 36 CFR 294.21:

1. **High quality or undisturbed soil, water, and air:** Healthy watersheds provide clean water for domestic, agricultural, and industrial uses; help maintain abundant and healthy fish and wildlife populations; and are the basis for many forms of outdoor recreation.
2. **Sources of public drinking water:** IRAs contain watersheds that are important sources of public drinking water. Careful management of these watersheds is crucial in maintaining the flow of clean water to a growing population.
3. **Diversity of plants and animal communities:** IRAs are better suited than roaded areas to support greater ecosystem health, including the diversity of native and desired nonnative plant and animal communities, due to the absence of disturbances caused by roads and accompanying activities.
4. **Habitat for threatened, endangered, proposed, candidate, and sensitive species, and for those species dependent on large, undisturbed areas of land:** Roadless areas function as biological strongholds and refuges for many species including threatened, endangered and sensitive species.
5. **Primitive, semi-primitive nonmotorized and semi-primitive motorized classes of dispersed recreation:** IRAs often provide outstanding recreation opportunities such as hiking, camping, wildlife viewing, hunting, fishing, and cross-country skiing. While IRAs may have many wilderness-like attributes; unlike Wilderness, the use of mountain bikes, and other mechanized means of travel is often allowed.

6. **Reference landscapes:** These roadless landscapes provide a natural setting that may be useful as a comparison to study the effects of more intensively managed areas.
7. **Natural appearing landscapes with high scenic quality:** High quality scenery, especially scenery with natural-appearing landscapes, is a primary reason that people choose to recreate. In addition, quality scenery contributes directly to real estate values in neighboring communities and residential areas.
8. **Traditional cultural properties and sacred sites:** Traditional cultural properties are places, sites, structures, art, or objects that have played an important role in the cultural history of a group. Sacred sites are places that have special religious significance to a group. Traditional cultural properties and sacred sites may be eligible for protection under the Natural Historic Preservation Act.
9. **Other locally identified unique characteristics:** IRAs may offer unique characteristics and values that are not covered by the other characteristics. Examples include uncommon geological formations, which are valued for their scientific and scenic qualities, or unique wetland complexes. Unique social, cultural, or historical characteristics may also be dependent on the roadless character of the landscape. Examples include ceremonial sites, places for local events, areas prized for collection of non-timber forest products, or exceptional hunting and fishing opportunities.

Idaho Roadless Areas – Wilderness Attributes/Potential

Wilderness attributes of IRAs have been described in the RARE II Wilderness Attribute Rating System, 1977 and more recently in 2005 Forest Service monitoring protocol, *Monitoring selected conditions related to wilderness character: a national framework* (Landres and others 2005) as untrammeled, natural, undeveloped, outstanding opportunities for solitude or a primitive and unconfined type of recreation, special features, and manageability:

1. **Untrammeled –** This quality monitors modern human activities that directly control or manipulate the components or processes of ecological systems inside wilderness. In summary, wilderness is essentially unhindered and free from modern human control or manipulation.
2. **Natural –** This quality monitors both intended and unintended effects of modern people on ecological systems inside wilderness since the time the area was designated. In summary, wilderness ecological systems are substantially free from the effects of modern civilization.
3. **Undeveloped –** This quality monitors the presence of structures, construction, habitations, and other evidence of modern human presence or occupation. In summary, wilderness is essentially without permanent improvements or modern human occupation.
4. **Outstanding opportunities for solitude or a primitive and unconfined type of recreation –** This quality monitors conditions that affect the opportunity for people to experience solitude or primitive, unconfined recreation in a wilderness setting, rather than monitoring visitor experiences per se. In summary, wilderness provides outstanding opportunities for people to experience solitude or primitive and unconfined recreation, including the values of inspiration and physical and mental challenge:

5. **Special Features-** Unique geological, ecological, cultural or scenic features, which may be located in Roadless areas. Unique fish and wildlife species, unique plants or plant communities, potential Research Natural Areas, outstanding landscape features such as rock formations, and significant cultural resource sites are some of the items which should be considered when analyzing this element.
6. **Manageability/Boundaries-** Is a measure of Forest Service's ability to manage an area to meet size criteria and the five elements discussed above. Changes in the shape of Roadless areas and the location of other proposed projects outside the area are also factors, which should be considered. Boundary management impacts relate to such factors as the need to change the boundaries to terrain features that can be easily located, and the provision of access to the remainder of the Roadless area.
7. ***Research Natural Areas in the SCNF***

Table Q-2: Designated Research Natural Areas (RNA) across the Salmon-Challis National Forest

Name	Acres	Primary Feature(s)	Major Habitat Types, Communities, and/or Species	In Wild?	In IRA?
Allan Mountain	1650	Stands of subalpine larch from seedlings to mature trees, at the southeastern limit of its range, mature whitebark pine, high-elevation grasslands	*Abies lasiocarpa/Calamagrostis canadensis - Ledum glandulosum, Abies lasiocarpa/Menziesiia ferruginea, Abies lasiocarpa/Xerophyllum tenax - Vaccinium globulare, Abies lasiocarpa/Xerophyllum tenax - Vaccinium scopulorum, Abies lasiocarpa/Xerophyllum tenax - Luzula hitchcockii, Pinus albicaulis - Abies lasiocarpa, Larix lyallii - Abies lasiocarpa*	n	y
Bear Valley Creek	2530	Extends from relatively low elevations to alpine conditions thus embracing a wide variety of forest and grassland conditions typical of this part of the Lemhi mountains. It contains sagebrush-grass vegetation in places on lower south-facing slopes to mostly forest vegetation of Douglas-fir, subalpine fir, and whitebark pine types with increasing elevation, with a cap of alpine vegetation on the ridgetop of the north-facing slope.	*Pseudotsuga menziesii/Calamagrostis rubescens, Pseudotsuga menziesii/Festuca idahoensis, Pseudotsuga menziesii/Cercocarpus ledifolius, Pseudotsuga menziesii/Svmphoricarpos oreophilus, Picea enqelmannii/Carex disperma, Abies lasiocarpa/Vaccinium scoparium, Abies lasiocarpa/ Calamagrostis canadensis, Ledum qlandulosum, Abies lasiocarpa/ Calamagrostis ubescens, Abies lasiocarpa/Streptopus amplexifolius, Abies lasiocarpa/Linnaea borealis, Abies lasiocarpa/Juniperus communis,*	n	y

Name	Acres	Primary Feature(s)	Major Habitat Types, Communities, and/or Species	In Wild?	In IRA?
			Pinus albicaulis - Abies lasiocarpa, Artemisia tridentata ssp. Vaseyana/Festuca idahoensis		
Cache Creek Lakes	795	Provides representation of subalpine forest, whitebark pine woodland, wet meadow plant communities, lotic and lentic aquatic systems, and scree, talus, and cliff plant communities on volcanic rock substrate in the Central Idaho Section of the Northern Rocky Mountain Province.	*Abies lasiocarpalJuniperus communis, Abies lasiocarpa/Vaccinium scoparium Pinus albicaulis phase, Abies lasiocarpa/Carex geyeri Carex geyeri phase, Abies lasiocarpa/Ledum glandulosum*	y	n
Colson Creek	280	It is a relatively low-elevation area along the Salmon River not far above the junction of the Salmon River with the Middle Fork of the Salmon representing certain shrub and grass habitat types in very good condition. It is an excellent area for the study of factors affecting the distribution of species in unusually good condition.	*Pinus ponderosa/Agropyron spicatum, Pinus ponderosa/Festuca idahoensis, Pinus ponderosa/Glossopetalon nevadense, Pseudotsuga menziesii/Festuca idahoensis, Glossopetalon nevadense/Agropyron spicatum, Cercocarpus ledifolius/Agropyron spicatum, Artemisia tridentata var tridentata/Agropyron spicatum, Artemisia tripartita/Agropyron spicatum, Artemisia tripartita/Festuca idahoensis, Festuca idahoensis/Lupinus, Agropyron spicatum/Balsamorhiza sagittata*	n	n

Name	Acres	Primary Feature(s)	Major Habitat Types, Communities, and/or Species	In Wild?	In IRA?
Davis Canyon	1215	A small watershed dominated by rock talus and few alpine and subalpine plants at higher elevations with five Douglas-fir (*Psuedostuga menziesii*) habitat types, three subalpine fir (*Abies concolor*), and lodgepole pine (*Pinus contorta*) communities on the slopes below. Elk sedge (*Carex geyeri*) flourishes and beargrass (*Xerophylum tenax*) is abundant even though it is at the southern limit of its range in the Beaverhead Mountains.	*Cercocarpus ledifolius/Agropyron spicatum, Psuedostuga menziesii/Carex geyeri, Psuedostuga menziesii/Calamagrostis rubescens, Psuedostuga menziesii/Spiraea betulifolia Calamagrbstis rubescens phase, Psuedostuga menziesii/Vaccinium globulare, Psuedostuga menziesii/Physocarpus malvaceus Calamagrostis rubescens phase, Psuedostuga menziesii/Physocarpus malvaceus Pinus ponderosa phase, Psuedostuga menziesii/Xerophyllum tenax, Abies lasiocarpa/Carex geyeri, Abies lasiocarpa/Xerophyllum tenax Vaccinium scoparium phase, Abies lasiocarpa/Menziesia ferruginea, Pinus albicaulis-Abies lasiocarpa, Pinus albicaulis*	n	y
Dome Lake	1415	Scattered whitebark pine (*Pinus albicaulis*) occurs near the summit of Dome Mountain, while the upper forest supports several subalpine fir (*Abies lasiocarpa*) habitat types. A number of Douglas-fir (*Pseudotsuoa menziesii*) types dominate the middle to lower elevation slopes and excellent spruce (*Picea enqelmannii*) stands can be found near mid-elevation, moraine-dammed Dome Lake.	*Pseudotsuga menziesii/Calamagrostis rubescens, Pseudotsuga menziesii/Vaccinium globulare, Pseudotsuga menziesii/Physocarpus malvaceus, Abies lasiocarpa/Calamagrostis canadensis, Abies lasiocarpa/Vaccinium globulare, Abies lasiocarpa/Vaccinium scoparium, Abies lasiocarpa/Xerophyllum tenax, Abies lasiocarpa/Menziesia ferruginea, Pinus albicaulis-Abies lasiocarpa, Picea engelmannii/Galium triflorum*	y	n

Name	Acres	Primary Feature(s)	Major Habitat Types, Communities, and/or Species	In Wild?	In IRA?
Dry Gulch-Forge Creek	3235	Very diverse vegetation: Idaho fescue/bluebunch wheatgrass, basin big sagebrush/bluebunch wheatgrass, mountain mahogany/bluebunch wheatgrass, Douglas-fir/mountain mahogany, Douglas-fir/bitterbrush, Douglas-fir/mountain maple, stands of aspen, a waterfall, hot and cold springs, streams, rare plants, granitic and volcanic rock substrates. About 60 percent of the RNA is in the Frank Church River of No Return Wilderness.	*Pinus ponderosa/Agropyron spicatum, Pseudotsuga menziesii/Agropyron spicatum, Pseudotsuga menziesii/Festuca idahoensis, Pseudotsuga menziesii/Cavex geyeri, Pseudotsuga menziesii/Cercocarpus ledifolius, Pseudotsuga menziesii/Calamagrostis rubescens, Pseudotsuga menziesii/Symphoricarpos albus, Pseudotsuga menziesii/Acer glabrum, Pseudotsuga menziesii/Physocarpus malvaceus, Abies lasiocarpa/Vaccinium scoparium, Abies lasiocarpa/Carex geyeri, Artemisia tridentata var. tridentata/Agropyron spicatum, Artemisia tridentata var. vaseyana/Agropyron spicatum, Artemisia tridentata var. vaseyana/Festuca idahoensis, Festuca idahoensis/Agropyron spicatum, Cercocarpus ledifolius/Agropyron spicatum*	p	p
Frog Meadows	330	The Frog Meadows RNA is a relatively high elevation area containing old-growth lodgepole pine forests and wet meadows. Part of the lodgepole pine forests have converted to the climax stand of subalpine fir. Located primarily within the Frank Church River of No Return Wilderness except a narrow strip along Forest Road 113.	*Abies lasiocarpa/Vaccinium scoparium, Abies lasiocarpa/Carex geyeri, Abies lasiocarpa/Calamagrostis rubescens, Abies lasiocarpa/Calamagrostis canadensis*	p	n
Gunbarrel	1600	Within the area that burned very hot during the 1961 Corn Creek Fire. Vegetation consists of a mixture of forbs, grass, browse, and tree seedlings (principally ponderosa pine and Douglas-fir, with some lodgepole pine). There is one younger stand on the east side of the Gunbarrel Creek drainage composed of Douglas-fir	*Pinus ponderosa, Pseudotsuga menziesii, Cercocarpus ledifolius, Agropyron spicatum*	y	n

Name	Acres	Primary Feature(s)	Major Habitat Types, Communities, and/or Species	In Wild?	In IRA?
		and ponderosa pine that was not consumed by the fire.			
Iron Bog	434	Iron bog, a sphagnum bog, is unique because of its location in a relatively dry ecosystem. The RNA also contains representative Douglas-fir habitat types.	*Abies lasiocarpa/Ledum glandulosum, Pseudotsuga menziesii/Arnica cordifolia, Pseudotsuga menziesii/Symphoricarpos oreophilus, Artemisia tridentata spp. vaseyana/Festuca idahoensis/Agropyron spicatum, Artemisia nova/Festuca idahoensis*	n	y
Kenney Creek	1580	The RNA includes two small basins, one with a small lake. It contains several whitebark pine (*Pinus albicaulis*), Douglas-fir (*Pseudotsuga menziesii*), and subalpine fir (*Abies lasiocarpa) habitat types and includes* a number of wet meadows.	*Pinus albicaulis/Vaccinium scoparium, Pinus albicaulis/Carex geyeri, Pinus albicaulis/Juniperus communis, Pinus albicaulis/Festuca idahoensis, Picea engelmannii/Carex disperma, Abies lasiocarpa/Calamagrostis rubescens, Abies lasiocarpa/Calamagrostis rubescens, Pseudotsuga menziesii/Calamagrostis rubescens, Pseudotsuga menziesii/Spiraea betulifolia, Pseudotsuga menziesii/Carex geyeri, Pseudotsuga menziesii/Festuca idahoensis*	n	y
Mahogany Creek	3650	Extensive stands of curlleaf mountain mahogany (Cercocarpus ledifolius), also present are limber pine (*Pinus flexilus*), whitebark pine (*Pinus albicaulis*) unusual at this elevation this far north, common juniper (*Juniperus communis*), Engelmann spruce (*Picea engelmanii*), subalpine fir (*Abies lasiocarpa*), scenic awe-inspiring geology.	*Pinus flexilis/Juniperus communis, Pinus flexilis/Cercocarpus ledifolius, Pinus flexilis/Festuca idahoensis, Pinus flexilis/Hesperchloa kingii, Pinus albicaulis/Juniperus communis, Pinus albicaulis/Festuca idahoensis, Pseudotsuga menziesii/Festuca idahoensis, Pseudotsuga menziesii/Arnica cordifolia, Pseudotsuga menziesii/Cercocarpus ledifolius, Pseudotsuga menziesii/Juniperus communis, Abies lasiocarpa/Juniperus communis, Abies lasiocarpa/Ribes montigenum, Abies lasiocarpa/Arnica cordifolia, Picea engelmannii/Juniperus communis, Cercocarpus ledifolius/Agropyron*	n	y

Name	Acres	Primary Feature(s)	Major Habitat Types, Communities, and/or Species	In Wild?	In IRA?
			spicatum, Artemisia vaseyana/Festuca idahoensis		
Meadow Canyon	3880	The Meadow Canyon RNA includes two of the finest alpine tundra areas to be found in Idaho, an unusual number of rare plant species, forest communities of Douglas-fir and Engelmann (at least one of which is rare), substrates mainly of limestone but also of quartzite which, with climate, affect the character and distribution of plants. It also harbors uncommon species of wildlife, the Rocky Mountain goat, the prairie falcon, and the golden eagle.	*Pseudotsuga menziesii/Symphoricarpos oreophilus, Pseudotsuga menziesii/Symphoricarpos oreophilus Syor phase, Pseudotsuga menziesii/Arnica cordifolia, Pseudotsuga menziesii/Juniperus communis, Pseudotsuga menziesii/Cercocarpus ledifolius, Pinus flexilis/Festuca idahoensis, Agropyron spicatum/Festuca idahoensis*	n	y
Merriam Lake Basin	740	Seldom in Idaho is the combination of substrates and moisture gradients at high elevations so varied as occur in the Merriam Lake Basin RNA. As a result, the alpine vegetation is very diverse. Enclosed in a rather small basin are numerous alpine communities, including one area supporting a vegetation typical of tundra over 2,400 miles to the north.	*Pinus albicaulis-Abies lasiocarpa plus unclassified alpine habitat types*	n	y
Middle Canyon	2200	Although Middle Canyon RNA is within the Northern Rocky Mountain Geomorphic Province, vegetation of the Canyon is more representative of the Basin and Range Province and represents the northern limit of several Great Basin species. Middle Canyon contains limestone cliffs and unusual geological features, diverse vegetation including species and habitat types not represented in other established RNA's in Idaho, several rare or unusual plant species, and outstanding scenic attractions.	*Pseudotsuga menziesii/Cercocarpus ledifolius, Pseudotsuga menziesii/Juniperus scopulorum, Pseudotsuga menziesii /Juniperus communis, Pseudotsuga menziesii/Leucopoa kingii, Cercocarpus ledifolius/Agropyron spicatum, Pinus flexilis, Artemisia nova/Agropyron spicatum*	n	y

Name	Acres	Primary Feature(s)	Major Habitat Types, Communities, and/or Species	In Wild?	In IRA?
Mill Lake	720	The Mill Lake RNA is an alpine and subalpine high-elevation area with small lakes and wet meadows, all in excellent condition. It was originally selected to represent alpine and subalpine conditions with precambrian base rocks, largely quartzite. Although alpine areas are limited in Idaho, Mill Lake RNA harbors unique vegetation.	*Abies lasiocarpa/Vaccinium scoparium, Pinus albicaulis-Abies lasiocarpa, unclassified alpine habitats*	n	y
Mystery Lake	517	Consists of a glaciated basin in the headwaters of Mystery Creek in the relatively arid central portion of the Salmon River Mountains. The basin encompasses several lakes that vary in size and productivity. Representative of subalpine fir forest and whitebark pine woodland representing the xeric end of their respective habitat and series. There are a considerable number of talus/cliff plant communities at the upper elevations.	*Abies lasiocarpa/Juniperus communis, Abies lasiocarpa/Vaccinium scoparium, Abies lasiocarpa/Carex geyeri, Abies lasiocarpa/Calamagrostis Canadensis, Pinus albicaulis - Abies lasiocarpa*	y	n
Sheep Mountain	1542	Subalpine turf communities	*Pinus albicaulis, Alpine meadow turf and fellfield communities, Salix nivalis, Leucopoa kingii, Carex elynoides, Carex upestns, Calamagrostis purpurascens, Ivesia gordonii, Dryas octopetala*	n	p
Smiley Mtn	3080	Diverse alpine vegetation communities, whitebark pine, high-elevation cirques and wetlands, diverse geology characteristic of the Pioneer Mountains of Idaho	*Alpine communities, Ivesia gordonii fellfield, Pinus albicaulis, Picea engelmannii, Abies lasiocarpa, Festuca idahoensis*	n	y
Soldier Lake	175	High-elevation warm and cool permanent ponds and cold lakes with and without fish, subalpine fir forests	*Abies lasiocarpa/Vaccinium scoparium, Abies lasiocarpa/Calamagrostis canadensis Ledum, landulosum phase, Abies lasiocarpa/Luzula hitchcockii, Abies lasiocarpa/Carex geyeri, Abies lasiocarpa/Juniperus communis, Pinus albicaulis/Abies*	y	n

Name	Acres	Primary Feature(s)	Major Habitat Types, Communities, and/or Species	In Wild?	In IRA?
			lasiocarpa		
Surprise Valley	1470	High-elevation glacially formed hanging valley with outstanding geologic features, subalpine, timberline, and alpine communities, and aquatic values.	*Abies lasiocarpa/Juniper communis, Pinus albicaulis-Abies lasiocarpa, Artemisia tridentata vaseyana/Festuca idahoensis, Picea engelmannii, Pinus flexilis, Salix sp, Carex proposita, Penstemon procerus var. formosus, Erigeron simplex, Ovis canadensis, Oreamnos americanus, Ochotona princeps*	n	y

In Wild: all or part of the RNA is located within Wilderness.
In IRA: all or part of the RNA is located with an Idaho roadless area.
The designation of “p” means partially in either Wilderness and/or IRA

Appendix R: Livestock Use Restrictions by Herbicide

Table R-1: Livestock use restricitions by herbicide

Herbicide	Brand Name	Restriction	Remarks
2,4-D amine		Remove meat animals from treated area 3 days before slaughter.	2,4-D labels vary.
Aminopyralid	1. Milestone Chaparral™ 2. CleanWave® 3. ForeFront® R&P 4. GrazonNext® 5. Milestone® 6. Milestone® VM 7. Milestone® VM Plus 8. Opensight™ 9. Pasturall	Allow 3 days of grazing/feeding in non-exposure area before moving livestock onto broadleaf cropland.	
Chlorsulfuron	Telar, Glean, Corsair, Landmark (oust + telar)	None	
Clopyralid	Transline, Redeem (Clopyralid + Triclopyr)	Redeem: Do not graze treated areas until poisonous plants are dry and no longer palatable to livestock. Withdraw livestock from grazing treated grass at least 3 days prior to slaughter.	See label for cropland grazing restrictions post treatment in pastures. Redeem: Herbicide application may increase palatability of poisonous plants.
Dicamba	Clarity Banvel	No waiting period between treatment and grazing for nonlactating animals. Remove meat animals from treated areas 30 days prior to slaughter.	
Glyphosate	RoundUp, Rodeo, etc.	None	RoundUp: ingestion of this product or large amounts of freshly sprayed vegetation may cause temporary gastrointestinal irritation.
Imazamox	Clearcast	None	
Imazapic	Plateau	Plateau: None. Plateau DG: Do not use on areas to be grazed.	
Imazapyr	Arsenal, Chopper, Stalker	Arsenal: none. Chopper: none. Stalker: none.	
Metsulfuron methyl	(Escort)/Sulfonylurea	None.	
Picloram	Tordon	Tordon 101/22K/K: allow one week of	

Herbicide	Brand Name	Restriction	Remarks
		grazing/feeding in non-exposure area before moving livestock onto broadleaf cropland. Tordon 22K: herbicide application may increase palatability of poisonous plants. Don't graze treated areas until poisonous plants are dry and no longer palatable. Meat grazing animals should be removed from treated areas 2 weeks after treatment and 3 days prior to slaughter.	
Sulfometuron methyl	Oust	None	
Triclopyr triethylamine salt (TEA)		None	

Appendix S: Noxious Weed Species Acreages by Allotment in the Salmon-Challis National Forest

Table S-1: Noxious Weed Species Acreages by Allotment in the Salmon-Challis National Forest

Allotment	Noxious Weed Species Acres																				Grand Total
	ACRE3	BEIN2	CADR	CANU 4	CEDI3	CEMA 4	CHJU	CHLE 80	CIAR4	COAR 4	CYOF	EUES	HYNI	LELA2	LIGED	LIVU2	ONAC	PORE 5	TARA	TRTE	
Agency Creek				24.2		63.8	0.1		5.6					0.2			0.1				94.0
Alder Creek				0.2		0.8			0.8			32.7	4.4								38.8
Antelope	0.1			47.3		23.2			9.5			33.8									113.8
Arco Pass			1.8	0.1	0.1	1.6			0.6			50.4	8.1								62.8
Arentson Gulch			0.1																		0.1
Baldy Mountain				107.1		24.6			13.7				7.3								152.8
Big Creek						16.8															16.8
Boone Creek			35.7			0.3			30.7												66.6
Briggs Canyon									1.1			1.1									2.3
Bull Trout						0.1															0.1
Burns Basin		78.7	0.3	12.2		1,835.9	0.6	1.1	34.1		75.6		3.5			0.1		16.8			2,059.0
Camas Creek		229.7				867.6	0.3		4.9		0.1	0.3	0.1		10.5	7.6		0.1			1,121.3
Camp Creek - BLM						30.4															30.4
Cape Horn S + G						3.0	0.1		7.0									0.0			10.1
Carmen Creek		0.1				6.3			0.1		0.8	16.0									23.3
Cedarville				0.3		0.2			126.2		0.9	1.0									128.6
Challis Creek						6.4															6.4
Cherry Creek					3.7				0.4			136.5									140.6
Clear Creek-Panther Creek		730.1	0.0	0.1		4,439.8	73.7		6.6		0.2							16.4	0.4	0.1	5,267.4
Copper Basin				67.1	0.0	109.7			297.8			126.0	8.7								609.3
Cow Creek				30.4		245.7			89.2									4.4			369.7

Allotment	Noxious Weed Species Acres																				Grand Total
Crows Nest												2.1									2.1
Deer Park						1.0															1.0
Deer-Iron Creek						587.6										0.1					587.7
Diamond Moose		132.1		67.2		1,524.4	27.0		40.6		40.9	40.8	4.9			16.8		6.5			1,901.1
Dry Fork									0.1												0.1
Eddy Creek						20.4			18.1			0.1									38.5
Fish Creek							1.4		3.9												5.2
Forney		0.5		0.1		577.5	0.1		4.4		14.1	0.1				4.5					601.4
Fourth of July Ck		4.7		0.8		275.6			34.0		61.5	5.7						0.7			383.0
Garden Creek				0.6		177.8			0.0												178.4
Gilmore				6.4		4.3															10.6
Grizzly Hill				153.0		231.3			81.4		71.6	68.8	16.3								622.4
Hat Creek		22.2			0.2	91.3			5.3		0.2										119.1
Hawley Creek			0.2	78.9		41.6			15.1			0.2									136.2
Haynes Creek				57.1		97.1			17.0									0.0			171.2
HES 541						0.1															0.1
Horse Creek									0.1												0.1
Hot Springs			1.9	10.3		154.2			12.0												178.4
Hot Springs - BLM				0.0		0.0															0.0
Hurst Canyon									135.9												135.9
Indian Ridge		176.7		9.3		4,303.3	0.3	117.9	10.1		442.1		8.1		0.1			129.1			5,197.1
Jumpoff													0.1								0.1
Lake Creek		0.1	0.2	0.1		582.6			1.6												584.6
Lawson Creek						33.4			6.1												39.5
Leadbelt				0.1			0.1		10.9												11.1
Lee Creek				57.0		65.2			45.3												167.6

Allotment	Noxious Weed Species Acres																				Grand Total
Little Eightmile						16.3															16.3
Loon Creek		0.0				74.3	0.2					1.6						0.3			76.4
Lower Cedar				0.1					0.1			0.0									0.2
Marco Creek									0.2												0.2
Marsh Canyon				0.1		0.4			0.3			203.2									204.0
Meadow Creek									9.2												9.2
Mill Creek			0.0	35.3		67.1			457.0	0.2			33.9								593.5
Mollie Gulch												7.2									7.2
Morgan Creek		0.1		16.4		1,098.4		0.5	22.6							4.1		2.5			1,144.6
Napoleon Gulch		0.1				8.7			0.5			2.8	0.1			0.9					13.2
Nez Perce						82.5															82.5
Nez Perce - BLM				0.7		28.5															29.2
North Basin						143.9			0.1				0.1								144.1
North Fork						0.2			13.9												14.1
North Hayden						5.1															5.1
Pahsimeroi				192.1																	192.1
Park Creek						4.2			64.2												68.4
Pass Creek				16.6		98.3			262.1			9.1	10.4			35.1					431.5
Pattee Creek				0.7		91.1	0.1		0.7		0.1		0.2				0.1				93.1
Peterson Creek				4.0		33.5						0.3									37.8
Powderhorn						10.2															10.2
Ramshorn				1.2								72.3									73.5
Rock Springs				330.5					330.5			0.1									661.2
Sage Creek		136.0				3,323.5	0.2		1.0		3.7					0.1		0.1			3,464.8
Salmon River Breaks				0.2	0.1	64.5	0.2		40.3		0.1					117.4					222.9
Sandy Creek									0.1												0.1

Allotment	Noxious Weed Species Acres																				Grand Total
Sheep Creek		16.0				667.6		0.1	0.0			0.3				0.1		0.1			684.3
South Fork Williams Creek						237.9			0.8												238.7
South Hayden				6.9		30.9			18.3												56.2
Spring Gulch				0.1																	0.1
Spud Creek						11.7			0.2												11.8
Squaw Creek				0.1		48.1	0.1		16.9		7.1	0.1				16.8					89.2
Sulphur Creek				37.9																	37.9
Swan Basin						77.1			0.2												77.3
Tenmile						18.4			0.3												18.6
Tex Creek				5.6		52.0															57.7
Trail Creek									17.9												17.9
Twelvemile						190.3	0.1								0.1						190.5
Udy Pasture				0.0		3.9															3.9
Uncle Ike						4.0						4.0									7.9
Upper Hayden		0.2		114.9		529.1			106.2				6.7					4.7			761.7
Wildhorse			0.2		0.0	18.0			0.2			8.1	82.6		0.3						109.4
Williams Basin-Napias Creek		17.7	0.1	70.3		2,676.4	6.5	0.0	62.1		27.2	0.1									2,860.5
Williams Creek									0.1												0.1
Willow Creek			0.3	12.6		0.2						0.8	88.0								102.0
Wino Basin			0.1	149.8					118.2												268.2
Withington Creek			8.9			187.9			8.4									5.7			210.9
Grand Total	**0.1**	**1,545.0**	**49.8**	**1,726.2**	**4.2**	**26,349.3**	**111.3**	**119.7**	**2,623.0**	**0.2**	**746.2**	**825.7**	**283.5**	**0.2**	**11.0**	**203.7**	**0.2**	**187.3**	**0.4**	**0.1**	**34,787.0**

ACRE3- Russian Knapweed
BEIN2- Hoary Alyssum

CADR- Whitetop
CANU4- Musk Thistle
CEDI3- Diffuse Knapweed
CEMA4- Spotted Knapweed
CHJU- Rush Skeletonweed
CHLE80- Oxeye Daisy
CIAR4-Canada Thistle
COAR4- Field Bindweed
CYOF- Houndstongue
EUES- Leafy Spurge
HYNI- Black Henbane
LELA2- Perennial Pepperweed
LIGED- Dalmatian Toadflax
LIVU2- Yellow Toadflax
ONAC- Scotch thistle
PORE5- Sulphur Cinquefoil
TARA- Saltcedar
TRTE- Puncturevine

Appendix T: Directions for Viewing Layers on Maps 1 through 5- Invasive Plant Infestations by Weed Zone

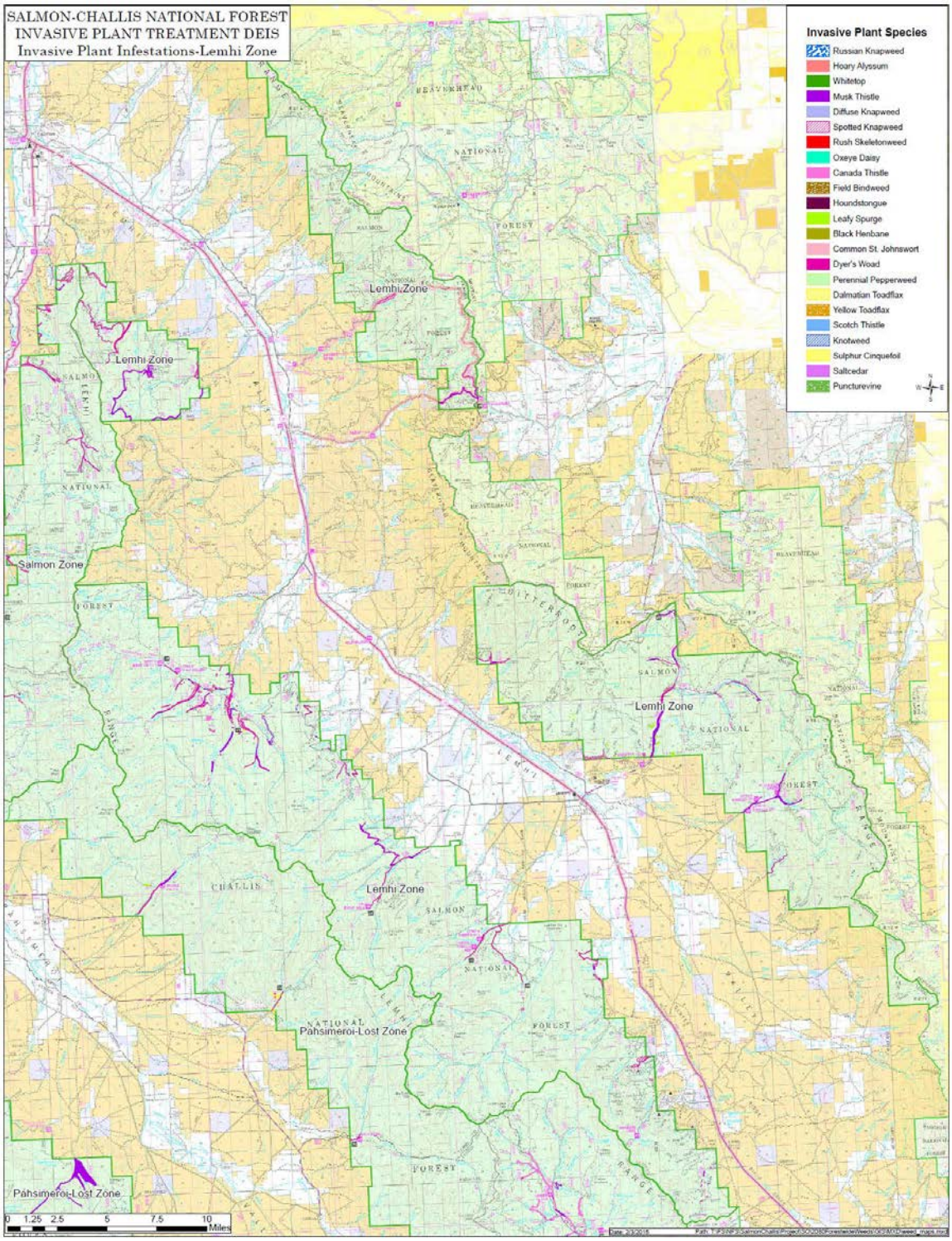
Maps 1-5 are also available online at: Salmon-Challis National Forest's website. Scroll to Salmon-Challis Forestwide Integrated Weed Management and click the link.

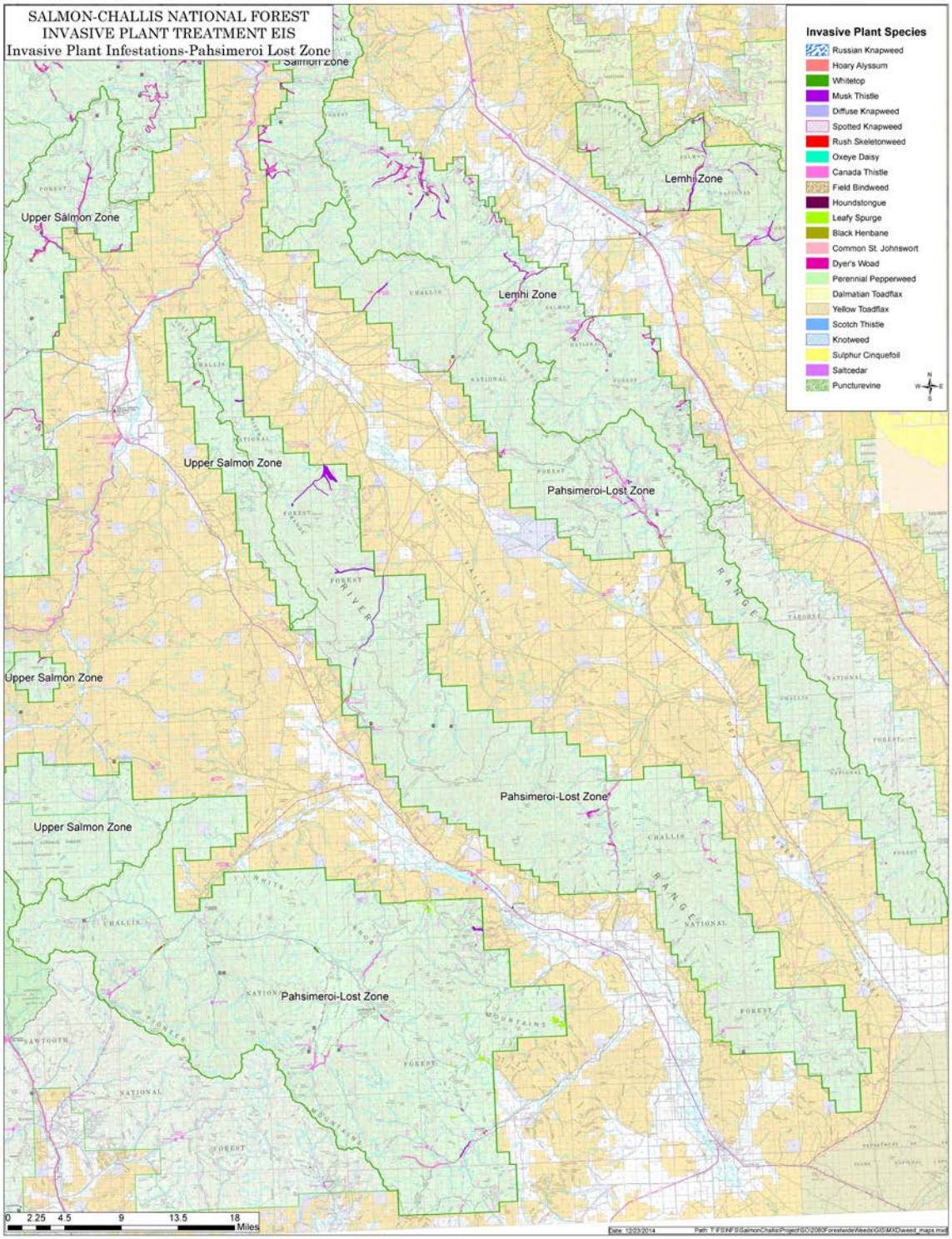
To view data layers:

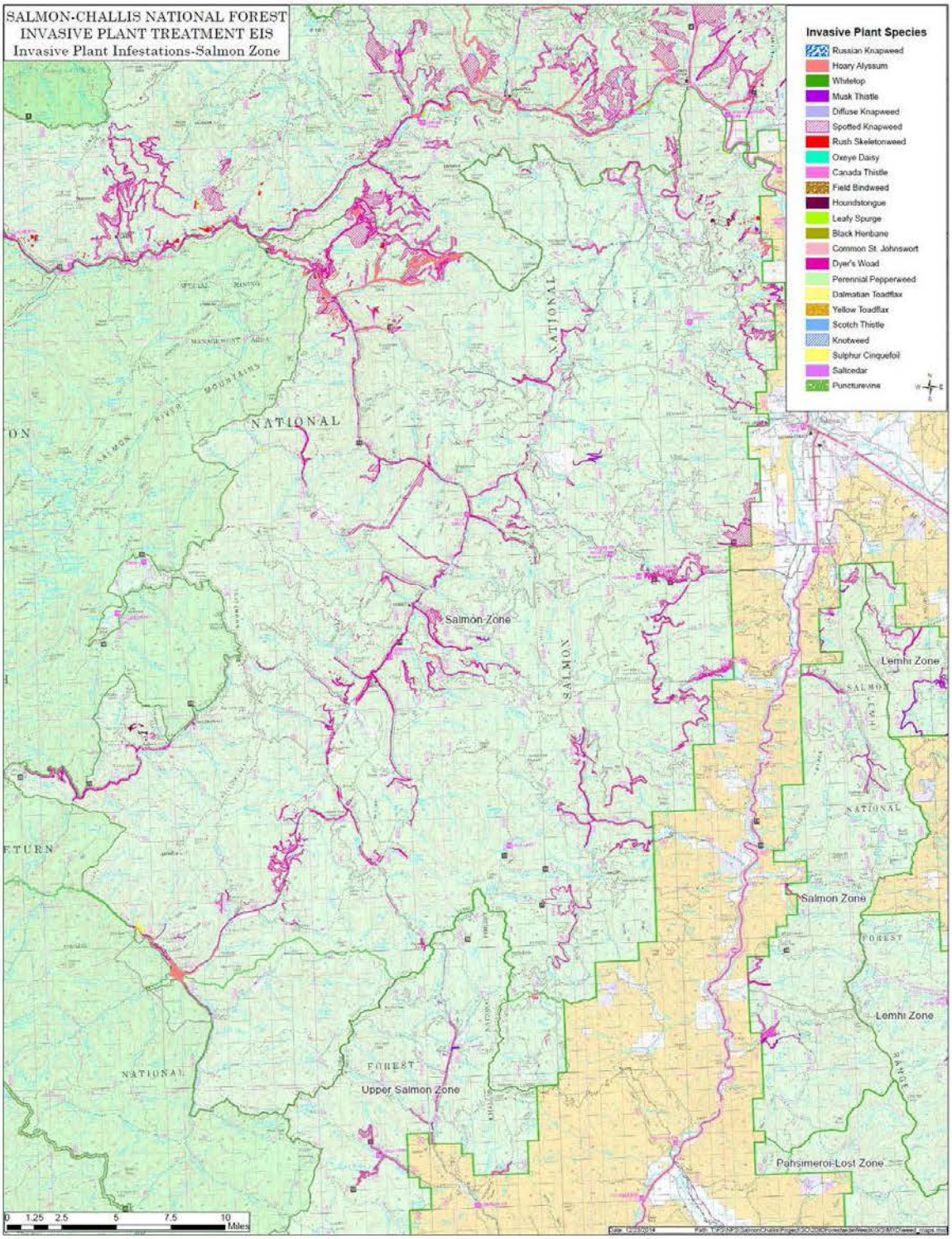
- select the Layer icon from the Acrobat toolbar on the left (fourth icon down)
- Select the plus (+) sign to expand the Layer table of contents
- A list of infestations by species will appear- each layer can be turned on or off by selecting the "eye" icon to the left of each item.

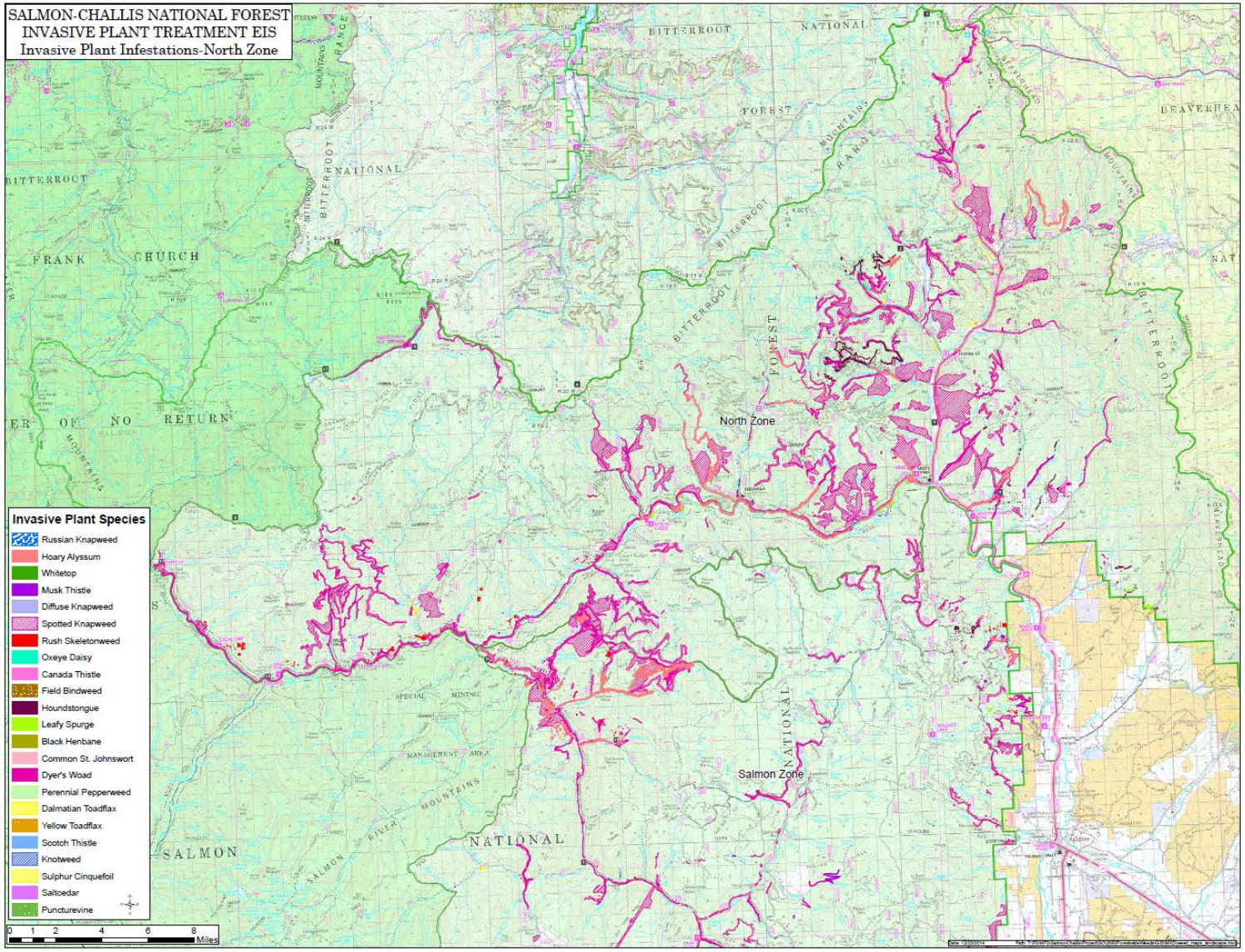
Hint: If the left toolbar is absent, hover your mouse/cursor over the lower center of your internet navigator page or document window. A grey toolbar should appeat, which has an Adobe Acrobat icon on the right side. Click on this icon to show Acrobat toolbars. The fourth icon down on the left Acrobat toolbar (Layer: View layers and show/hide their contents) will open the Layer table of contents with the above-described functionality. Note that in this copy of the document all layers are visible.

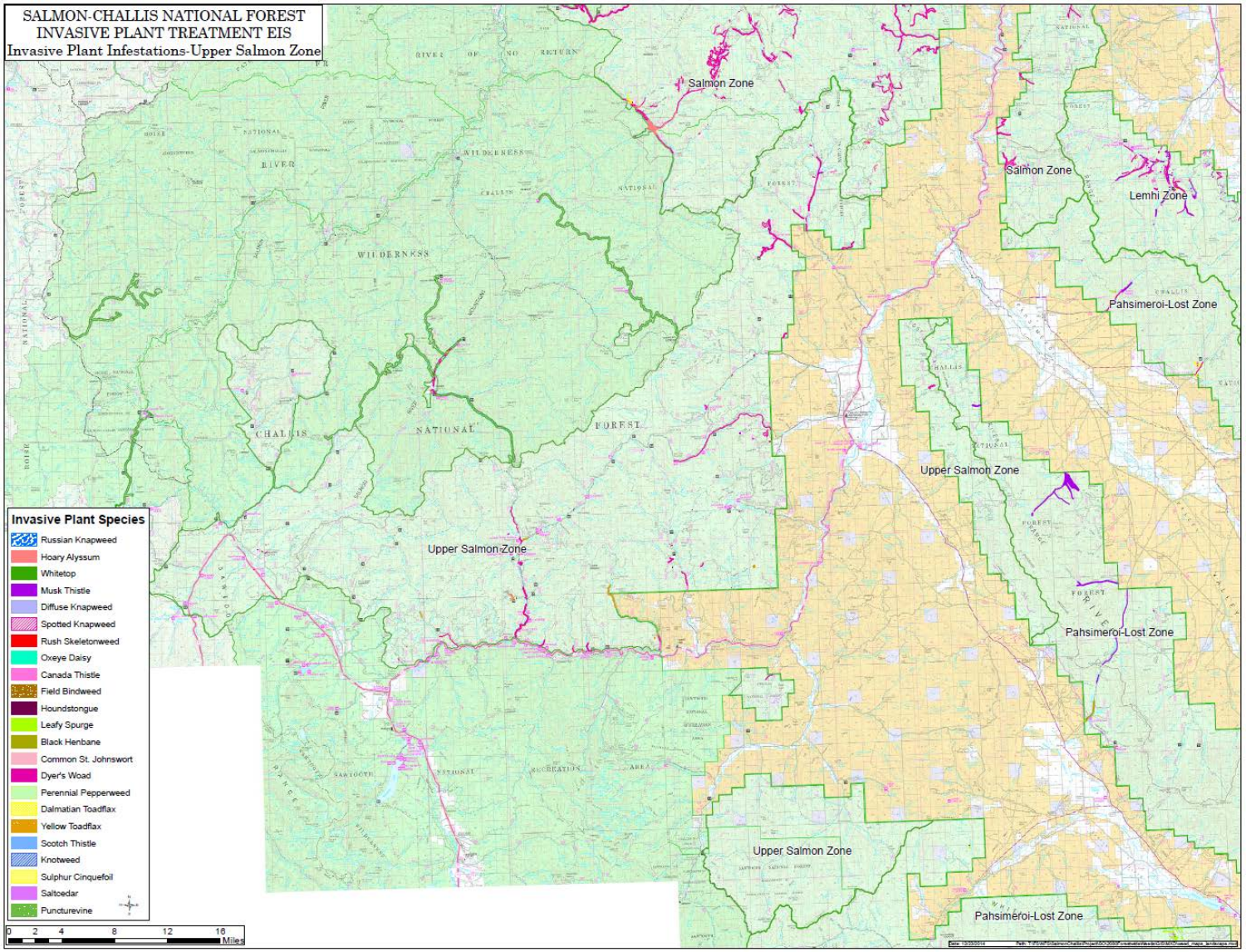
For assistance viewing the data layers in Maps 1 through 5, you may contact Jennifer Purvine at: (208)879-4162 or jpurvine@fs.fed.us


SALMON-CHALLIS NATIONAL FOREST
INVASIVE PLANT TREATMENT DEIS
Invasive Plant Infestations-Lemhi Zone
Invasive Plant Species
Russian Knapweed
Hoary Alyssum
Whitetop
Musk Thistle
Diffuse Knapweed
Spotted Knapweed
Rush Skeletonweed
Oxeye Daisy
Canada Thistle
Field Bindweed
Houndstongue
Leafy Spurge
Black Henbane
Common St. Johnswort
Dyer's Woad
Perennial Pepperweed
Dalmatian Toadflax
Yellow Toadflax
Scotch Thistle
Knotweed
Sulphur Cinquefoil
Saltcedar
Puncturevine
Lemhi Zone
Salmon Zone
Pahsimeroi-Lost Zone
0 1.25 2.5 5 7.5 10 Miles


SALMON-CHALLIS NATIONAL FOREST
INVASIVE PLANT TREATMENT EIS
Invasive Plant Infestations-Pahsimeroi Lost Zone
Invasive Plant Species
Russian Knapweed
Hoary Alyssum
Whitetop
Musk Thistle
Diffuse Knapweed
Spotted Knapweed
Rush Skeletonweed
Oxeye Daisy
Canada Thistle
Field Bindweed
Houndstongue
Leafy Spurge
Black Henbane
Common St. Johnswort
Dyer's Woad
Perennial Pepperweed
Dalmatian Toadflax
Yellow Toadflax
Scotch Thistle
Knotweed
Sulphur Cinquefoil
Saltcedar
Puncturevine
Salmon Zone
Lemhi Zone
Upper Salmon Zone
Lemhi Zone
Upper Salmon Zone
Pahsimeroi-Lost Zone
Upper Salmon Zone
Pahsimeroi-Lost Zone
Upper Salmon Zone
Pahsimeroi-Lost Zone
0 2.25 4.5 9 13.5 18 Miles


SALMON-CHALLIS NATIONAL FOREST
INVASIVE PLANT TREATMENT EIS
Invasive Plant Infestations-Salmon Zone
Invasive Plant Species
Russian Knapweed
Hoary Alyssum
Whitetop
Musk Thistle
Diffuse Knapweed
Spotted Knapweed
Rush Skeletonweed
Oxeye Daisy
Canada Thistle
Field Bindweed
Houndstongue
Leafy Spurge
Black Henbane
Common St. Johnswort
Dyer's Woad
Perennial Pepperweed
Dalmatian Toadflax
Yellow Toadflax
Scotch Thistle
Knotweed
Sulphur Cinquefoil
Salicedar
Puncturevine
Salmon Zone
Lemhi Zone
Salmon Zone
Lemhi Zone
Upper Salmon Zone
Pahsimeroi-Lost Zone
0 1.25 2.5 5 7.5 10 Miles


SALMON-CHALLIS NATIONAL FOREST
INVASIVE PLANT TREATMENT EIS
Invasive Plant Infestations-North Zone
North Zone
Salmon Zone
Invasive Plant Species
Russian Knapweed
Hoary Alyssum
Whitetop
Musk Thistle
Diffuse Knapweed
Spotted Knapweed
Rush Skeletonweed
Oxeye Daisy
Canada Thistle
Field Bindweed
Houndstongue
Leafy Spurge
Black Henbane
Common St. Johnswort
Dyer's Woad
Perennial Pepperweed
Dalmatian Toadflax
Yellow Toadflax
Scotch Thistle
Knotweed
Sulphur Cinquefoil
Saltcedar
Puncturevine
0 1 2 4 6 8 Miles


SALMON-CHALLIS NATIONAL FOREST
INVASIVE PLANT TREATMENT EIS
Invasive Plant Infestations-Upper Salmon Zone
Salmon Zone
Salmon Zone
Lemhi Zone
Pahsimeroi-Lost Zone
Upper Salmon Zone
Upper Salmon Zone
Pahsimeroi-Lost Zone
Upper Salmon Zone
Pahsimeroi-Lost Zone
Invasive Plant Species
Russian Knapweed
Hoary Alyssum
Whitetop
Musk Thistle
Diffuse Knapweed
Spotted Knapweed
Rush Skeletonweed
Oxeye Daisy
Canada Thistle
Field Bindweed
Houndstongue
Leafy Spurge
Black Henbane
Common St. Johnswort
Dyer's Woad
Perennial Pepperweed
Dalmatian Toadflax
Yellow Toadflax
Scotch Thistle
Knotweed
Sulphur Cinquefoil
Saltcedar
Puncturevine
0 2 4 8 12 16
Miles

Appendix U: Response to Comments

1
2
3
4

Mt. Borah Ranch LLC
5872 Highway 93
Mackay, Idaho 83251
Ph: 208-588-2218

United States Department of Agriculture
Salmon-Challis National Forest
Supervisor's Office
1206 S. Challis
Salmon, Idaho 83467
208-756-5100

To whom it may concern:

Following comments are in regard to the Salmon-Challis National Forest Invasive Plant Treatment Draft Environmental Impact Statement.

Upfront, I am glad that the noxious weeds are getting the attention they deserve, I will list my concerns regarding your practices in direct relation to our range allotment #5701 Arentson Gulch allotment.

1. Exercize caution with treatments near private property.
2. Use indicator dye, which in your plan you state you do use it.
3. Work in coordination with the permittee
   a. Grazing permittees will be made aware of annual treatment actions at the permittee annual operating instruction meetings and/or if **requested, notified in advance of spray dates. My request is here noted**
   b. This also means to, depending upon chemical, place notice placards on entry gates for withdrawal times before entry on aerial applications or broadcast applications. Spot spraying usually does not have as much caution.
   c. If possible to coordinate so cows are not in the treated allotment. This is extremely important when treating spotted knapweed because cows eat the buds/blooms of the plant. Usually treatment is before bud but cows still eat on the species. It would be best to not have the herbicide present at the same time the cows are in the allotment. On #5701, dates of herd movement are listed on range report .
4. All Forest Service vehicles are to be washed down so as not to carry other invasive species when entering Range Allotment #5701.
   You may contact my cell phone (Steve W. Smith) 208-339-1220

Sincerely

Steve W. Smith

Steve W. Smith 2-27-2015

Commnet #	Response to Comments
1	Design criteria were developed to minimize public exposure to chemical weed treatments. Specifically, information regarding where chemical treats are occurring is to be made public and there would be a buffer to private land adjacent to aerial treatment locations (Appendix J).
2	Indicator dye will be used during herbicide application.
3	Design criteria for notification of livestock permittees were developed and included in the alternatives (Appendix J).
4	The Salmon-Challis Weed Management Prevention Plan (Appendix C) identifies washing weed seed from vehicles.

1

From: Rodgers, Ken -FS on behalf of FS-comments-intermtn-salmon-challis
To: Purvine, Jennifer B -FS; Nelson, Kimberly D -FS; Winfield, Jay -FS
Cc: Krieger, Karryl -FS
Subject: FW: Invasive Plant Treatment DEIS
Date: Friday, March 06, 2015 2:58:06 PM

From the comments inbox

-----Original Message-----
From: Diamond D Ranch [mailto:diamonddgnestranch@mac.com]
Sent: Friday, March 06, 2015 2:22 PM
To: FS-comments-intermtn-salmon-challis
Subject: Invasive Plant Treatment DEIS

To be clear, there will be no treatment plan INSIDE of the Frank Church Wilderness Area?

I spend my summers at the Diamond D Ranch on Loon Creek. In 2006 I had a life threatening, anaphylactic reaction to a spray used on weeds along the road and at the Loon Creek FS Station. I had to be life flighted out of the ranch. It appears my system cannot take these chemicals. I am an owner/operator, so not being at the ranch is not an option for me.

Please be clear as to where the spraying (ie - treatment of these weeds) will take place and do I have reason to be concerned.

Thank you for your time,

Kara Demorest
Diamond D Ranch

Comment #	Response to Comments
1	Public notification of herbicide application in areas of special concern is identified in the EIS (Appendix J). Every attempt will be made to make that information widely available to the public. People who have sensitivities are encouraged to contact the SCNF and request specific notification.

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6

INVASIVE PLANT TREATMENT DEIS
March 12, 2015

Attn: Jennifer Purvine
From: Lemhi County Cattle & Horse Growers Association
29 Allison Creek RD
Salmon, ID 83467
hemiller65@yahoo.com

Thank you for inviting comments on the DFIS. We have not reviewed the entire document; however, we read the summary. There are five actions analyzed – 1) No Action; 2) Current Management; 3) Proposed Action; 4) No Aerial Herbicide; and 5) No Aquatic Herbicide. Our summary of each of these actions is as follows.

No Action Alternative – This alternative has been practiced on many Ranger Districts since the inception of USFS. The result has been undesirable plant infestations that could have been readily and inexpensively controlled when the infestation was first observed growing to the point that they require very expensive control. We do not support this Alternative.

Current Management Alternative – Current management has improved markedly in the past 30 years. The Salmon-Challis Forest now at least has a control plan with stated objectives for each zone. All Ranger Districts now do some invasive plant management and responsibility for the program is outlined up to the Supervisor's Office.

Proposed Action (Preferred Alternative) – This alternative is basically Current Management with the addition of up to 16 thousand acres of aerial herbicide application. As far as invasive plant treatment is concerned, this is an excellent alternative; however, we think USFS is overly optimistic in thinking that they would have the financial resources or the manpower commitment to manage this size aerial herbicide program. We support this Alternative with the caveat that resources be first concentrated on the Current Management Program focusing on 1) new infestations; 2) travel corridors (roads & trails); and economic and environmental effects of current specific (ex. Leafy spurge, Rush skeleton weed) weed infestations.

No Aerial Application Alternative – This alternative appears to the most environmentally benign on the face; however, realistically sometimes the most inexpensive and responsible treatment is helicopter herbicide application. This is especially true for small scattered infestations of highly invasive plants. We do not support this alternative.

No Aquatic Herbicide – Judicious use of aquatic herbicides may be required for specific invasive plant infestations. Realistically, there may be no other alternative. So, we do not support this alternative.

In conclusion, we support the proposed action. We believe, however, that considerable effort has already been expended in identifying and mapping current infestations of undesirable plants and a major new effort in this direction is not warranted. Each USFS employee has a responsibility to help identify new plant infestations and plant identification training for potential new invasives should be part of each Ranger District's annual training program.

Again, thank you for inviting comment.

Comment #	Response to Comment
1	Preference noted.
2	Preference noted.
3	Preference noted.
4	Preference noted.
5	Preference noted.
6	The Salmon-Challis Weed Management Prevention Plan (Appendix C) identifies employee education as an action item.

1

United States Department of the Interior

OFFICE OF THE SECRETARY
Office of Environmental Policy and Compliance
620 SW Main Street, Suite 201
Portland, Oregon 97205-3026

IN REPLY REFER TO:
9043.1
ER15/0092

Electronically Filed

March 30, 2015

Attn: Jennifer Purvine
Salmon-Challis National Forest
HC 63 Box 1669
Challis, ID 83226

Dear Ms. Purvine:

The Department of the Interior has reviewed the Draft Environmental Impact Statement for the U.S. Forest Service Forest-wide Invasive Plant Treatment Environmental Impact Statement, Salmon-Challis National Forest, Idaho. The Department has no comments on the document at this time.

We appreciate the opportunity to comment.

Sincerely,

Allison O'Brien
Regional Environmental Officer

Comment #	Response to Comments
1	Noted.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 Sixth Avenue, Suite 900
Seattle, WA 98101-3140

OFFICE OF
ECOSYSTEMS, TRIBAL AND
PUBLIC AFFAIRS

March 30, 2015

Charles Mark
Forest Supervisor
Salmon-Challis National Forest
1206 South Challis Street
Salmon, Idaho 83467

Dear Mr. Mark:

In accordance with our responsibilities under Section 309 of the Clean Air Act, the National Environmental Policy Act, and the Council on Environmental Quality regulations for implementing NEPA, the U.S. Environmental Protection Agency has reviewed the Draft Environmental Impact Statement (DEIS) for the proposed **Invasive Plant Treatment Project** (EPA Region 10 Project number: 11-026-AFS) on Salmon-Challis National Forest (SCNF) in Butte, Custer, and Lemhi Counties, Idaho.

The DEIS analyzes potential environmental impacts associated with activities to prevent, detect, control and manage invasive plants on the SCNF. The treatment area would be more than 31 million acres of public land, of which over 49,000 acres are now infested with invasive plants. New infestations are also occurring at an annual rate of 10-24%. Treatments would include biological (2,000 acres), manual/mechanical (2,000 acres), and chemical (16,000 acres) methods. The proposed program would be implemented over the next 10-15 years or until conditions substantially change.

Analysis of impacts from the project considered five action alternatives, 1-5, including a No Action (Alternative 1). Differences between the alternatives relate to treatment acreage, methods, and cost per acre treated. Under the Proposed Action and Preferred Alternative (Alternative 3), the Forest Service (FS) would implement an adaptive integrated weed management strategy to eradicate or control existing or newly discovered invasive plants on about 20,000 acres each year over the next ten to fifteen years. Treatment methods would include biological, manual/mechanical, and herbicide applications (ground, aerial, and aquatic). Those options would be implemented singly or in combination with each other to manage the invasive plants. There would also be rehabilitation and restoration of sites and continued monitoring to ensure treatments are achieving desired outcomes. Alternatives 4 and 5 would be similar to Alternative 3, but would exclude use of aerial and aquatic herbicide applications, respectively. Under Alternative 2, current management of invasive plants would continue without change. The Proposed Action, therefore, expands the current invasive plant management program with the addition of three new herbicides and inclusion of aerial herbicide application and aquatic invasive plant treatment strategies.

The EPA supports treatment of invasive plant infestations to maintain or improve the diversity, function and sustainability of desired native plant communities and other natural resources that can be adversely impacted by invasive plant species. We note with appreciation that the DEIS addresses many of the

issues we raised during the project scoping period in August 2011, including analysis of cumulative and climate change effects. The DEIS includes a good description of resources within the project area, anticipated environmental impacts, and measures to offset adverse impacts that could result from the proposed project activities. Also, we are pleased with the inclusion of monitoring as an important component of the project because it ensures progress towards meeting the goals of the proposed program can be measured and reported, and compliance with regulatory requirements, including environmental standards, are adhered to throughout the program period. We support aspects of the Preferred Alternative, particularly the ability of this alternative to restore sites to natural functions and native species.

We have some concerns regarding the project as currently proposed because of potential impacts to air and water quality, vegetation and wildlife, and other resources as discussed in our attached detailed comments. We are concerned that the DEIS does not include air quality data analysis for the project. The proposed action could impact air quality due to herbicide use, especially aerial application. Therefore, we are unable to determine whether proposed treatments would result in emissions that would exceed Prevention of Significant Deterioration thresholds or National Ambient Air Quality Standards. The final EIS should include air quality data; discuss impacts to air quality from this project and other sources of emissions; and implications for nearby sensitive receptors e.g., the Frank Church River of No Return Wildness area.

Regarding water quality, we recommend that the Forest Service continue to work with the Idaho Department of Environmental Quality (IDEQ) and tribes affected by the project to assure that the state and tribal water and air quality standards will be met throughout the project period. The DEIS indicates there are water quality impaired rivers and streams within the analysis area. Total Maximum Daily Loads (TMDLs) have been completed for some, but not all, of these water bodies. The final EIS should indicate how the Forest Service will work with IDEQ to ensure compliance with Water Quality Restoration Plans that will function as the Forest Service's share of implementing existing TMDLs in the project area and vicinity. We note with appreciation that various rehabilitation and restoration activities proposed, in addition to similar actions taken by the Cooperative Weed Management Area participants, will contribute positively to water quality restoration within water bodies on SCNF.

Because there are fish-bearing rivers and streams (p. 3.156) and species that are listed as endangered or threatened (e.g., Sockeye salmon), a candidate for listing (e.g., Greater sage-grouse), and sensitive (e.g., Westslope Cutthroat Trout) the Forest Service should coordinate with the US Fish and Wildlife Service and National Marine Fisheries Service, as well as Idaho Department of Fish and Game as appropriate to reduce risks to species and protect biota and habitat during implementation of this project. The final EIS should include any additional relevant information developed as a result of coordination with these agencies, particularly outcomes of consultations with the agencies and recommended measures to protect fisheries and other species.

Based on our review and concerns about water and air quality and unclear or missing information, we have assigned a rating of EC-2 (Environmental Concerns – Insufficient Information) to the DEIS. For your reference, a copy of the rating system used in conducting our review is enclosed.

2

We appreciate the opportunity to review this DSEIS. If you have question about our comments, please contact me at (206) 553-1601 or by electronic mail at reichgott.christine@epa.gov, or you may contact Theo Mbabaliye of my staff at (206) 553-6322 or electronic mail at mbahaliye.theogene@epa.gov.

Sincerely,

Christine B. Reichgott

Christine B. Reichgott, Manager
Environmental Review and Sediment Management Unit

Enclosure:
1. EPA Rating System for Draft Environmental Impact Statements

3

EPA Detailed Comments on the DEIS for
Invasive Plant Treatment Project
Salmon-Challis National Forest

Impacts to air quality
For better protection of public health from air pollution exposure, the EPA has set National Ambient Air Quality Standards (NAAQS) for six principal pollutants or criteria pollutants[1] to use to determine if emissions from a project would exceed daily and annual standards. Any project that would generate emissions exceeding the standards would have to include measures to demonstrate that, if implemented, the project would comply with both state and federal air quality regulations. Please also note that NAAQS are enforced by states, which might have additional or more stringent standards. Because the project area is adjacent to the Frank Church River of No Return Wilderness area, then, air quality analysis for this project should consider potential air pollution impacts from this and other projects to all sensitive receptors that may require protection from air quality deterioration and determine measures to take to reduce the impacts.

Because of the proposed project, there would be aerial application of herbicides on 8,000 acres, which could result in herbicide volatilization, drift, and potential movement with air currents as spray drifts away from the treatment site affecting air quality. In addition to impacts due to the proposed project, air quality may also be impacted due to cumulative impacts from surrounding activities such as road construction and use (regular traffic on dirt roads), site operations, emissions from vehicles using local roads, and cumulative impacts from surrounding activities, such as agriculture, fire, and use of woodstoves.

Recommendations:

1 - *The final EIS should consider all sources of emissions and determine the contribution of each source (including this project) to air quality within the analysis area and vicinity - negative or positive. This analysis should address and disclose the project's potential effects on all criteria pollutants under the NAAQS, including ozone; visibility impairment; and air quality related values in the protection of any affected Class I Areas, any significant concentrations of hazardous air pollutants, and protection of public health.*

2 - *Because the project area and vicinity may include sensitive populations such as the elderly and children, it will be important to monitor air quality and take corrective action to prevent further deterioration of air quality conditions in the area, particularly during proposed activities. Monitoring strategies should tailor to local conditions because localized air quality impacts can be substantial when area-wide and/or long term monitoring may show compliance with air quality regulatory requirements.*

3 - *The FS should coordinate with IDEQ and tribes affected by the project to assure emissions would be reduced in general and those due to the proposed action in particular.*

Impacts to water resources
The DEIS identifies water resources in the project area and provides information about impaired waters and the status of applicable Total Maximum Daily Loads (TMDLs) (p. 3.90). We note that the project area includes nearly 4,100 miles of perennial streams and almost 6,000 miles of intermittent or

[1] http://www.epa.gov/air/criteria.html

4

Comment #	Response to Comments
1	Change from DEIS: An air quality analysis (section 3.14) was added to the FEIS. Emission sources are addressed.
2	Change from DEIS: An air quality analysis (section 3.14) was added to the FEIS. Air quality monitoring requirements are addressed.
3	The Salmon-Challis National Forest is a member of the Montana/Idaho Airshed Group whose members include tribes and IDEQ.

ephemeral streams (p. 3.88); and that there are about 3,187 acres of small (less than 200 acres) and scattered lakes. Water quality within 61 rivers and creeks is impaired due to exceedances of the State of Idaho water quality standards for a variety of parameters, including sediment, temperature, bioassessment, fecal coliform, e-coli, and metals.

The DEIS further indicates that the largest concentrations of invasive plants occurs just within 300 ft. of some creeks including Trail and Panther, Canyon, Sawmill, and Pass. While the draft EIS identifies impaired water bodies within the project area and parameters for which they were listed, it does not include data about water quality criteria, specifically what the numeric water quality standard exceedances are for listed waters. Without that information, it is difficult to know whether the proposed weed treatments will exacerbate conditions in impaired streams or not. For specific actions that can be taken to address water quality impairments and restoration on national forest system lands, please also consult the Memorandum Of Agreement (September 28, 2007) between EPA and FS[2]. Please also note that the anti-degradation provisions of the Clean Water Act prohibit degrading water quality in water bodies that currently meet water quality standards.

As there are currently no aquatic invasive plants on the SCNF, we would expect that any new infestation will be dealt with using prevention and early detection/rapid response management actions so that the need for herbicide application directly to water bodies, especially to those that are impaired, does not arise. Source Water Protection Areas also exist within the project area (106,053 acres) and the DEIS shows that about 3,627 acres of those source water areas are currently infested with invasive plants (p. 3.92) which require treatment. In addition, the DEIS indicates that the project area includes numerous riparian areas covering a total of nearly 400,000 acres, and varying from narrow bands along headwater streams to expansive valley-wide floodplains in larger, low gradient channels (p. 3.80). It further states that all riparian acreage is within the Riparian Habitat Conservation Areas (RHCA), which are subject to the requirements of the Pacific Anadromous Fish/Inland Native Fish management strategies that limit ground-disturbing activities within RHCA. For improved protection of aquatic resources in RHCAs from the proposed project, we expect FS will adhere to prescribed buffers i.e., 300 ft. on all fish-bearing streams and 150 ft. on streams without fish.

Soils on the SCNF have high rock fragment content, which makes them course in texture, resulting in high infiltration rates (p. 3.93). Because of this, herbicides that are highly soluble in water, such as picloram, have the potential to leach into such soils and contaminate surface and groundwater, potentially causing exceedances of water quality and/or drinking water standards. This is especially concerning because of use of adjuvants which have not undergone complete risk assessment (p. 3.117). Further, the DEIS indicates that toxicities of herbicides when combined with adjuvants are not generally known and that their environmental fate remains largely undetermined. In addition, no water quality standards exist for three additional herbicides (aminopyralid, imazamox, and imazapyr) considered for use in the proposed action (p. 3.136). After application of some of these new herbicides on sandy soils, their concentrations are anticipated to be high due to their high leaching and persistence properties (p. 3.136). For example, aminopyralid has the highest mobility, with modeling suggesting that leaching can occur to 60 inches or greater in all soil types in average rainfall/cool climates and would more likely reach groundwater than all other herbicides considered (p. 3.138).

[2] http://water.epa.gov/lawsregs/lawsguidance/cwa/tmdl/upload/2007_09_28_15_16_08.pdf

While the use of the WEPP model to characterize soil erosion risks may be appropriate for this project, the model provides general guidance. The model requires data representative of the project area for useful estimation of soil erosion and compaction risks because effects on soils tend to occur in discrete areas. As the DEIS indicates, detailed soils data are limited on the SCNF (p. 3.92) and invasive plants are most prevalent in some land and vegetation cover types. For this reason, we support the FS's Aerial Herbicide Application Coordination and Safety Implementation Plan, which includes site specific analysis of the factors influencing the delivery of herbicides to surface water via overland flow in order to determine appropriate treatments which would minimize adverse effects (p. 3.133).

The DEIS notes many of the infestations in the SCNF are associated with roads, trails, paths, and other areas where the soil has been disturbed and/or compacted. Road prisms, road cuts, and road fills are also runoff-dominated features, which enhance runoff by concentrating flows on compacted road surfaces and in ditches, but also by intercepting groundwater flow from cut slopes (p. 3.180). As there are such settings on SCNF and 90% of noxious weed infestation throughout the SCNF occurs within only 0.25 miles of a road or trail (p. 3.11) the potential for discharge of sediment and herbicides to the waterbodies via surface runoff exists and may result in more significant impacts than anticipated.

We are concerned that treatments near 303(d) listed waters or road ditches that drain into waterways could further degrade water quality due primarily to sediment, herbicide, and temperature loadings. Extensive mechanical (soil disturbance) and chemical (creation of barren ground from invasive plant removal) treatment activities have the potential to increase erosion and sediment delivery to drainages. Applied herbicides could also be discharged to aquatic habitats via surface runoff, wind drift, leaching, or accidental spills. Cumulatively, water quality could also be impacted as a result of cumulative effects from other projects on the SCNF, including, but not limited to, road and trail construction and maintenance activities, livestock grazing along drainages, and recreational activities adjacent to drainages.

Recommendations:

- *The final EIS should include:*
  - *A summary of the results of site specific analyses of factors influencing the delivery of herbicides to surface water via overland flow in the analysis area and recommended measures to take to reduce adverse effects.*
  - *Numeric standards for which impaired streams are 303(d) listed and data demonstrating that state and tribal water quality standards would be met by this project.*
  - *Discussion on how invasive plants within buffer zones would be treated and measures to take to prevent deterioration of water quality within nearby waterbodies.*
  - *Risk assessment data for adjuvants proposed for use on the SCNF.*
- *The final EIS should identify added precautions that will be used when applying treatments near streams or road ditches that drain in the streams to minimize or avoid drift impacts and sublethal effects to aquatic life. For example, FS should avoid application of Picloram and other herbicides with very high toxicity to fish and movement rate to water sources within annual flood plains with water table close to the surface and high soil permeability.*

6

Comments #	Response to Comments
4	Overland flow is discussed in the Soil and Water (section 3.3.6.2 and 3.3.6.3) and Fisheries (section 3.4.6.3 and 3.4.6.4) Resources analyses. Design criteria were developed to protect aquatic resources (Appendix J).
5	In the Soil and Water Resources section, all 303(d) listed streams are within the project area are identified. Potential effects of invasive plant treatments in regards to 303(d) parameters are analyzed in sections 3.3.6.2, 3.3.6.3, 3.3.6.4, and 3.3.6.5.
6	Invasive plant treatments and the effects of the treatments adjacent to waterbodies are discussed in the Soil and Water Resource sections 3.3.6.2, 3.3.6.3, 3.3.6.4, and 3.3.6.5.

9

10

- *Because there are fish-bearing rivers and streams, including species that are endangered, threatened, and rare and sensitive (p. 3.156-7), the final EIS should include outcomes of consultations with the National Marine Fisheries Service and recommended measures to reduce risks to fisheries as the proposed project is implemented.*
- *The FS should exclude application of herbicides with no water quality data near waterbodies and designated source water protection areas.*

Impacts to Vegetation and Wildlife

The DEIS discusses the proposed project impacts to vegetation and indicates that invasive plant species on the SCNF mostly invade grasslands, shrub lands and low elevation conifer cover types, especially sites where the soil and native vegetation have been disturbed. It also indicates that grasslands (377,188 acres) and low elevation mixed evergreen shrub (706,560 acres) cover types are particularly vulnerable to invasive plants due to lower annual precipitation, higher degree of human use, and a lack of a forest overstory to inhibit shade intolerant invasive plants (p. 3.43). Thus, they are also more susceptible to herbicide damage, especially seedlings/saplings and forbs. Application of herbicides, such as glyphosate, imazapyr and imazamox, have the potential to damage macrophytic species (wetland vegetation), resulting in reduced root and shoot growth, curling, chlorosis and/or necrosis and plant death (p. 3.65). The extent of that impact in the project area is not clear, however, because wetlands are only mapped for a small portion of the area (p. 3.88).

Of the herbicides used on the SCNF, glyphosate and 2,4-D are most likely to impact evergreen shrubs by killing living plant foliage they are deposited on when applied. The other herbicides also have the potential to kill or damage native or desirable forb species, especially during early invasion when invasive forb plants are intermixed with natives. Most invasive plant species on the SCNF are forbs and, therefore, are typically the most impacted non-target vegetation (p. 3.47). Grassland cover types, which usually host many native forb species, are also more heavily invaded in the project area (p. 3.50). Graminoids are susceptible to herbicide applications, particularly where glyphosate is used, even at low use rates (p. 3.49). Thus, the combined effect of applying herbicides on forbs and graminoids could result in significant impact to this plant community, with some impacts being permanent in case of plant death (p. 3.225).

In particular, aerial and herbicide applications may harm non-target forage and cover species than other methods (p. 3.251). Applications of sulfometuron methyl, for example, could result in injury or mortality of all age classes of shrubs. Deciduous and evergreen shrubs seedling injury or mortality could also result from the application of aminopyralid, chlorsulfuron, metsulfuron methyl, and picloram. Perennial grasses would also be vulnerable to herbicide application, especially those at seedling stage or younger. As the DEIS indicates, the number of acres treated annually will also increase in years in which herbicides would be applied aerially, which would also trigger an increase in the amount of broadcast application acreage, creating a concurrent increase in the adverse effects of herbicide application to non-target vegetation in areas treated aerially (p. 3.69).

Herbicide treatments could also impact wildlife and livestock due primarily to direct spray, accidental spills, drift, and ingestion of contaminated vegetation, prey species, or water. Effects to animals could include death, damage to vital organs, decrease in growth, decrease in reproductive output and condition of offspring, and increased susceptibility to predation. Wildlife in particular, could experience disruption

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Comment #	Response to Comments
7	The identity of inert ingredients such as adjuvants is considered proprietary information of the manufacturer and do not have to be disclosed on herbicide labels or Material Safety and Data Sheet. The Envrionmental ProtectionAgency (EPA) reviews the inert ingredients to be added to a formulated herbicide prior to registration. The lack of disclosure on the label of other ingredients in a formulation indicates that none of the inert ingredients present at a concentration of 0.1% or greater are classified as hazardous or toxic. During the preparation of the Forest Service risk assessments, data on inert ingredients was reviewed and no toxic substances were identified as being included in herbicide formulations used by the Forest Service. Adjuvants used on the SCNF are disclosed in Appendix D.
8	The FEIS includes design criteria that were developed to protect aquatic resources (Appendix J). Appendix E identifies herbicide application guidelines near water.
9	Endangered Species Act section 7 consultation was initiated prior to the release of the DROD and will be completed prior to the release of the ROD. Requirements of the consultation will be incorporated into the ROD.
10	All herbicides analyzed in the FEIS for application in or near water are labeled for such use.

of dispersal and foraging, which could expose some species to greater predation related to habitat and cover losses. The DEIS indicates that terrestrial and aquatic applications of herbicides are likely to alter vegetation and have secondary effects on animals, including food availability and habitat quality (p. 3.213).

While we appreciate ecological risk assessment data provided, we note that surrogate species e.g., honeybees as a surrogate for other terrestrial invertebrates, were used for analyses of effects on rare, threatened, or endangered, candidate for listing, and sensitive species due to lack of available studies. The assessment also addresses the species using the same toxicity endpoint for other non-special status species, which would not accurately predict outcomes. Additionally, the risk assessment did not include risks associated with incidents e.g., wind erosion that applicants are required to report. For example, the DEIS indicates that none of the acute or chronic exposure scenarios at any application rate of sulfometuron-methyl for mammals, birds, amphibians, or terrestrial invertebrates, resulted in a hazard quotient that exceeded the Level of Concern (p. 3.219), indicating that no incident is also likely to pose any risk to the species due to sulfometuron-methyl application. In 2002, however, use of sulfometuron-methyl to control cheat grass in a burned area of south central Idaho[3] resulted in off-target movement windblown dust and farmers in the area reported a high degree of crop loss that they attributed to this herbicide. Clearly, it is desirable to avoid off-target effects and identify measures to take, should they occur. Because of this, we believe that the ecological risk assessment may not be adequately and fully expressing real risks of the proposed action to populations of at-risk species or provide accurate data on direct, indirect or cumulative impacts on those populations and their habitats.

Recommendations:

11 • *The final EIS should identify all wetlands in the project area and include data on acreages, habitat types, values, functions, and predicted impacts from proposed activities.*

12 • *Herbicide risk assessment should include evaluation of risks from incidents for each herbicide proposed for use. It should also consider use of similar organisms as surrogates or species themselves.*

13 • *The final EIS should include outcomes of consultations with the US Fish and Wildlife Service and recommended measures to reduce risks to species and protect biota and habitat during implementation of the proposed project.*

Impacts of Climate Change

The DEIS discusses climate change and effects that would result from the proposed project (p. 3.359-64). We note that the DEIS states that, "it is not currently feasible to quantify indirect effects of individual or even multiple projects on global climate change, therefore determining significant effects on proposed projects or alternatives on global climate change cannot be made." The DEIS also states that, "the action alternatives likely would not impact greenhouse gas emissions." We believe the EIS would be strengthened by including additional information. Therefore, we recommend:

14 • *Inclusion of data specific to the proposed project and estimates of GHGs (e.g., from vehicular or aerial traffic) in the final EIS.*

[3] http://www.pesticide.org/get-the-facts/pesticide-factsheets/factsheets/sulfometuron

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Comment #	Response to Comment
11	Effects to wetlands resulting from invasive plant treatments are analyzed in the Soil and Water Resource sections 3.3.6.2, 3.3.6.3, 3.3.6.4, and 3.3.6.5. The FEIS includes design criteria that were developed to project aquatic resources, including wetlands (Appendix J). Identification of acreage, habitat types, values and functions of all wetlands is beyond the scope of this project.
12	The Forest Service contracted with Syracuse Environmental Research Associates, Inc. (SERA) to develop risk assessments that evaluate human health and ecological effects of herbicides using EPA studies and other peer-reviewed articles from the open scientific literature. Information from laboratory and field studies of herbicide toxicity, exposure, and environmental fate was used to estimate the risk of adverse effects to non-target terrestrial and aquatic organisms, humans, water, and soil from the herbicides considered for use in the SCNF. For each ecological risk assessment, a set of general exposure scenarios based on the low, typical, and maximum label rates of the herbicides are analyzed. For wildlife, exposure scenarios included the animal being directly sprayed; ingestion of contaminated vegetation, prey species, or water; grooming activities; and indirect contact with contaminated vegetation (SERA 2007b). Although the risk assessments have limitations, they represent the best science available.

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- *Consideration of approaches for climate impact assessment outlined in the Council on Environmental Quality's recent "Revised Draft Guidance for Greenhouse Gas Emissions and Climate Change Impacts*[4] *and include relevant information in the FEIS.*
- *Implementation of practicable mitigation practices for reducing GHGs during the invasive plant treatment period (10-15 years), such as using energy efficient equipment and limiting idling when possible.*

[4] https://www.whitehouse.gov/administration-services/initiatives/nepa/ghg-guidance

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Comment #	Response to Comment
13	Endangered Species Act section 7 consultation was initiated prior to the release of the DROD and will be completed prior to the release of the ROD. Requirements of the consultation will be incorporated into the ROD. Design criteria were developed to protect wildlife and habitat (Appendix J).
14	CEQ's Revised Draft Guidance on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in NEPA Reviews identifies that a quantitative analysis of GHG emissions is warranted if >25,000 metric tons CO2E is expected on an annual basis. It calls for a meaningful analyses of GHG emissions and suggests comparing estimated emission from a proposed action to global emissions unless the comparison would assist the public and decision maker. Implementation of SCNF Invasive Plant Treatment would not approach that threshold. A qualitative assessment of impacts of GHG emissions was made in the FEIS (Section 3.14).
15	CEQ's Revised Draft Guidance on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in NEPA Reviews requires considering the effects of climate change on the environmental consequences of a proposed action. The FEIS analyzed the direct and indirect effects of climate change effects on invasive plants and on the efficacy of treatment methods (Section 3.11).

U.S. Environmental Protection Agency Rating System for Draft Environmental Impact Statements Definitions and Follow-Up Action*

Environmental Impact of the Action

LO – Lack of Objections
The U.S. Environmental Protection Agency (EPA) review has not identified any potential environmental impacts requiring substantive changes to the proposal. The review may have disclosed opportunities for application of mitigation measures that could be accomplished with no more than minor changes to the proposal.

EC – Environmental Concerns
EPA review has identified environmental impacts that should be avoided in order to fully protect the environment. Corrective measures may require changes to the preferred alternative or application of mitigation measures that can reduce these impacts.

EO – Environmental Objections
EPA review has identified significant environmental impacts that should be avoided in order to provide adequate protection for the environment. Corrective measures may require substantial changes to the preferred alternative or consideration of some other project alternative (including the no-action alternative or a new alternative). EPA intends to work with the lead agency to reduce these impacts.

EU – Environmentally Unsatisfactory
EPA review has identified adverse environmental impacts that are of sufficient magnitude that they are unsatisfactory from the standpoint of public health or welfare or environmental quality. EPA intends to work with the lead agency to reduce these impacts. If the potential unsatisfactory impacts are not corrected at the final EIS stage, this proposal will be recommended for referral to the Council on Environmental Quality (CEQ).

Adequacy of the Impact Statement

Category 1 – Adequate
EPA believes the draft EIS adequately sets forth the environmental impact(s) of the preferred alternative and those of the alternatives reasonably available to the project or action. No further analysis of data collection is necessary, but the reviewer may suggest the addition of clarifying language or information.

Category 2 – Insufficient Information
The draft EIS does not contain sufficient information for EPA to fully assess environmental impacts that should be avoided in order to fully protect the environment, or the EPA reviewer has identified new reasonably available alternatives that are within the spectrum of alternatives analyzed in the draft EIS, which could reduce the environmental impacts of the action. The identified additional information, data, analyses or discussion should be included in the final EIS.

Category 3 – Inadequate
EPA does not believe that the draft EIS adequately assesses potentially significant environmental impacts of the action, or the EPA reviewer has identified new, reasonably available alternatives that are outside of the spectrum of alternatives analyzed in the draft EIS, which should be analyzed in order to reduce the potentially significant environmental impacts. EPA believes that the identified additional information, data, analyses, or discussions are of such a magnitude that they should have full public review at a draft stage. EPA does not believe that the draft EIS is adequate for the purposes of the National Environmental Policy Act and or Section 309 review, and thus should be formally revised and made available for public comment in a supplemental or revised draft EIS. On the basis of the potential significant impacts involved, this proposal could be a candidate for referral to the CEQ.

* From EPA Manual 1640 Policy and Procedures for the Review of Federal Actions Impacting the Environment, February, 1987.

Comment #	Response to Comments
16	Change from DEIS: Reference to EO 13693- reduction of per-mile GHG emissions from fleet vehicles over the next decade- added to FEIS (Section 3.11.2).

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To whom it may concern:

In regard to the Forest Service updated EIS on invasive.

Not reading the 600+ page document, but given a descriptive presentation on applications, and the different directives on applications by Diane Schmidt and team. I was very impressed with the directives that will now give us the ability to administer applications in areas that were not acceptable with earlier dated ways because of cost or type of chemical application.

The success of combatting the invasive depends on our ability to change our directive to enable our tools, and directives to multiply. The more tools we have in the tool box the more work we can do, going from our waters to our dry hillsides. We need these added options.

Lemhi County is very supportive on the direction the SCNF Weed Management Draft EIS is going in this war on the invasive.

Lemhi County Commissioners

Comment #	Response to Comments
1	Preference noted.