United States Department of Agriculture
Forest Service

Malheur National Forest Site-Specific Invasive Plants Treatment Project

Draft Environmental Impact Statement

Grant, Baker, Harney, Malheur and Crook Counties, Oregon

October 2013

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Malheur National Forest Site-Specific Invasive Plants Treatment Project Draft Environmental Impact Statement

Grant, Baker, Harney, Malheur and Crook Counties, Oregon

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The DEIS can be viewed and downloaded from the internet at http://www.fs.fed.us/nepa/nepa_project_exp.php?project=35614 In addition, an electronic copy on a CD or a hard copy is available upon request from Joseph H. Rausch using the contact information provided previously.

Abstract

This draft environmental impact statement (DEIS) discloses the effects of treating invasive plants in the Malheur National Forest. Invasive species were identified by the Chief of the Forest Service as one of the four threats to forest health (for more information see http://www.fs.fed.us/project/four-threats). Invasive plants are displacing native plants, potentially destabilizing streams, reducing the quality of fish and wildlife habitat; and degrading natural areas.

We propose to treat invasive plants using integrated treatment methods in cooperation with our neighbors, and in accordance with the R6 2005 ROD and other relevant management direction, to reduce the extent and impact of invasive plants. The underlying purpose of treating invasive plant infestations is 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.

The project area encompasses the entire 1,459,422-acre Malheur National Forest and 240,000 acres of the Ochoco National Forest that are managed by the Malheur Forest (previously known as the Snow Mountain Ranger District, now managed as part of the Emigrant Creek Ranger District.) for a total of nearly 1.7 million acres located in eastern Oregon. These 1.7 million acres is the acreage considered as the Malheur National Forest for purposes of this analysis. We estimate at this time (using our updated inventory), approximately 2,124 acres of invasive plants need to be suppressed, contained, controlled or eradicated.

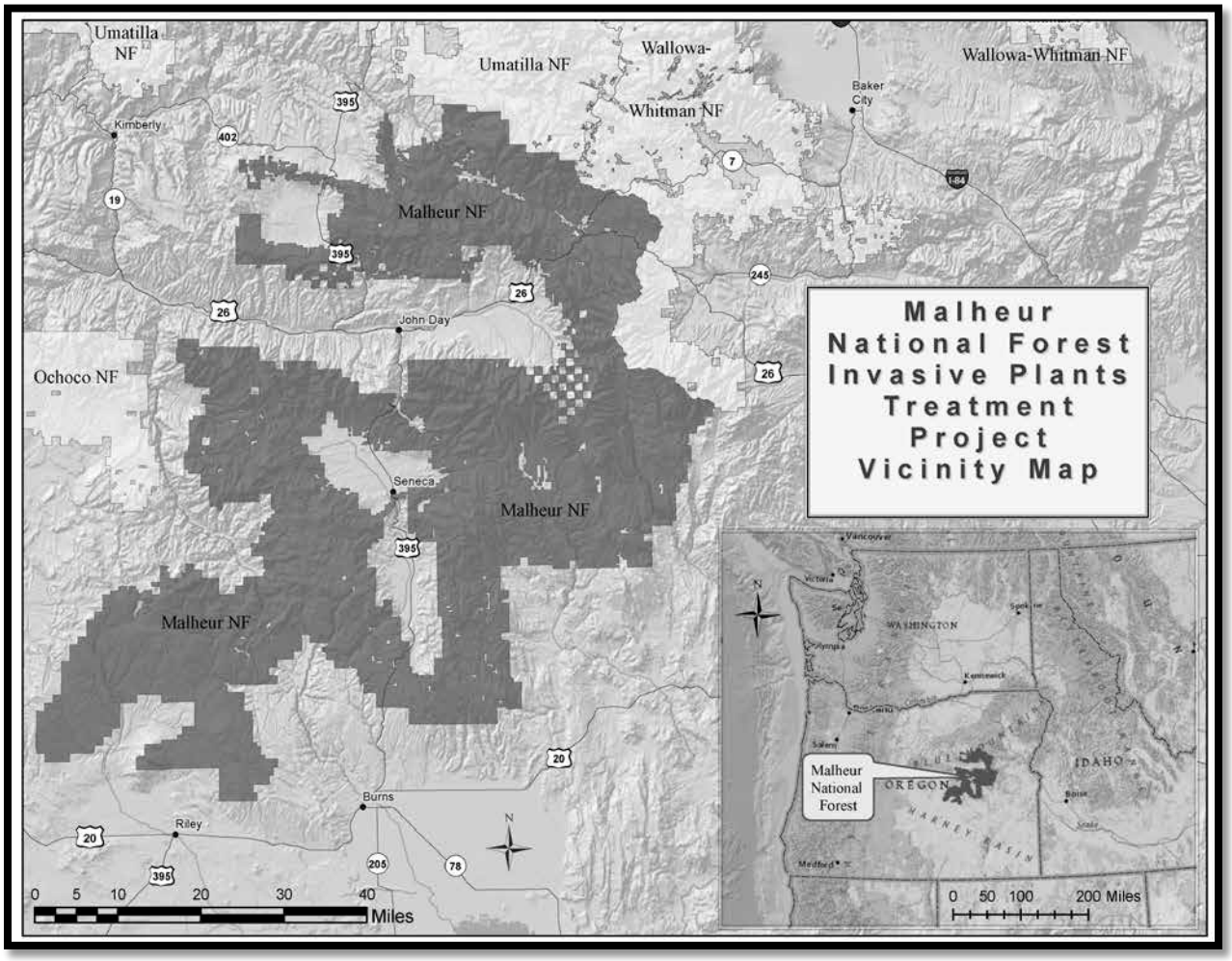
Invasive plant spread is unpredictable and actual locations of target species may change abruptly over time. Accordingly, we need the flexibility to adapt to changing conditions, and rapidly respond to invasive

plant threats that may currently be unknown. Timeliness of action is an important factor because the cost, difficulty, and potential adverse effects of controlling invasive plants increases with the size and extent of the population. The smaller the population when treated, the more likely the treatment will be effective. The proposed action includes a decision process and design features to ensure that treatments used for rapid response to new detections are within the scope of this analysis. This DEIS includes detailed consideration of four alternatives:

- Alternative A, the no-action alternative would not approve any invasive plant treatments.
- Alternative B, the proposed action, is our proposal as the most cost-effective approach to invasive plant treatment while minimizing the adverse effects of treatment. Alternative B responds to the purpose and need for action by authorizing several herbicide and other integrated treatment methods to be implemented on the Forest over the next 5 to 15 years. These options are intended to effectively reduce the size and density of invasive sites and abate the adverse effects of invasive plants. The project would continue to be implemented each year until the treatments were no longer needed or conditions substantially change on the ground to such a degree that the analysis in this EIS is no longer valid. The annual implementation planning process discusses how changed conditions would be evaluated for this project over time. This alternative would comply with standards and guidelines associated with invasive plant management and allow use of any of the 10 herbicides authorized for use in the R6 2005 ROD. It would also amend the Malheur National Forest Land and Resource Management Plan (LRMP) to allow the use of a new herbicide ingredient, aminopyralid.

Two action alternatives were developed in response to public issues related to herbicide use:

- Alternative C was developed in response to some public concerns about herbicide use on the Malheur National Forest. Alternative C would impose strict limitations on our ability to use herbicides to treat invasive plants. Compared to alternative B, alternative C responds to public issues about herbicide impacts to human health, non-target vegetation and pollinators, soils, water, aquatic organisms, and wildlife, while still allowing for some limited herbicide use. Under alternative C, all of the alternative components for alternative B would be followed (including a Malheur National Forest LRMP amendment to allow use of aminopyralid), however, no broadcasting of herbicide would be allowed. No boom spraying would be allowed. Maximum herbicide application rates per acre would be reduced by about 30 percent across the board. No herbicide use would be allowed within the boundaries of any mapped infested area that at any point is within 100 feet of creeks, lakes, ponds and wetlands. Picloram would be eliminated from the list of available herbicides.
- Alternative D, no Land and Resource Plan amendment and no aminopyralid, was developed to evaluate the tradeoffs involved with adding aminopyralid to the list of available herbicides in standard 16. Some members of the public have expressed doubt about whether or not this herbicide should be approved, mainly because it is new and effectively kills broadleaf plants. Alternative D would be similar to alternative B, except a Forest Land and Resource Management Plan amendment would not be completed and aminopyralid would not be approved for use on the Malheur National Forest. Aminopyralid would not be used to treat known sites or new detections. All of the components of alternative B would apply, except those that refer to aminopyralid would not be included.



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List of Acronyms

APHIS	Animal and Plant Health Inspection Service
ATV	All-terrain vehicle
AUM	Animal Unit Month
BA	Biological Assessment
BCC	Birds of Conservation Concern
BCR	Bird Conservation Region
BE	Biological Evaluation
BLM	Bureau of Land Management
BMP	Best Management Practices
BO	Biological Opinion
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CWA	Clean Water Act
d.b.h.	Diameter Breast Height
DEIS	Draft Environmental Impact Statement
DOG	Dedicated Old Growth
DN	Decision Notice
DPS	Distinct Population Segments
DWD	Down Woody Debris
EA	Environmental Assessment
EDRR	Early detection rapid response
EFH	Essential fish habitat
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FACTS	Forest Service Activity Tracking System
FEIS	Final Environmental Impact Statement
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FOSS	Federal OSHA Safety Standard
FP	Forest Plan
FS	Forest Service
FSH	Forest Service Handbook
FSM	Forest Service Manual
FWS	Fish and Wildlife Service
GIS	Geographical information system
GLEAMS	Groundwater Loading Effects of Agricultural Management Systems
GPS	Global positioning system
HEI	Habitat Effectiveness Index

HCB	hexachlorobenzene
HQ	Hazard quotient
HUC	Hydrologic Unit Codes
IDT	Interdisciplinary Team
INFISH	Inland Native Fish Strategy
IRA	Inventoried Roadless Areas
IWM	Integrated weed management
LAU	Lynx analysis units
LCAS	Lynx Conservation Assessment and Strategy
LOAEL	Lowest observed adverse effect level
LRMP	Land and Resources Management Plan
LWD	Large Woody Debris
MCR	Middle Colombia River
MIS	Management Indicator Species
MPG	Major Population Group
MPI	Matrix of Pathways and Indicators
MSA	Magnuson Stevens Act
NEPA	National Environmental Policy Act
NF	National Forest
NFMA	National Forest Management Act
NFS	National Forest System
NMFS	National Marine Fisheries Service
NOA	Notice of Availability
NOAEL	No observed adverse effect level
NOI	Notice of Intent
NPE	Nonylphenol Polyethoxylate
NSA	National Scenic Areas
NST	National Scenic Trails
NVUM	National Visitors Use Monitoring
ODFW	Oregon Department of Fish and Wildlife
OHV	Off-highway vehicles
ONF	Ochoco National Forest
OR	Oregon
ORV	Outstanding Remarkable Values
OSU	Oregon State University
PA	Proposed Action
PACFISH	Pacific Native Fish Strategy
PCE	Primary Constituent Elements
pdf	Project design feature
PIF	Partner in Flight
PFA	Post Fledgling Area
PNW	Pacific Northwest
POEA	Polyoxyethylene alkylamine
PPE	Personal Protective Equipment
R6	Forest Service Pacific Northwest Region Six
RHCA	Riparian Habitat Conservation Area
RMO	Riparian Management Objectives
RNA	Research Natural Areas
ROD	Record of Decision
ROG	Replacement Old Growth
ROS	Recreation Opportunity Spectrum
ROW	Right of Way
SERA	Syracuse Environmental Research Associates, Inc.
SHPO	State Historic Preservation Office
SMU	Species Management Units
SOLI	Species of local interest
TES	Threatened, Endangered and Sensitive
TMDL	Total maximum daily load
TNC	The Nature Conservancy
USDA	United States Department of Agriculture
USDI	United States Department of Interior
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey

WA	Washington
WEPP	Water Erosion Prediction Project
WSR	Wild and Scenic River

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Summary

Introduction

Invasive species were identified by the Chief of the Forest Service as one of the four threats to forest health (for more information see http://www.fs.fed.us/project/four-threats). Invasive plants are currently damaging the ecological integrity of lands. They are displacing native plants, increasing the potential for soil erosion and potentially destabilizing streams, reducing water quality and the quality of fish and wildlife habitat, and degrading natural areas. Invasive plants can have adverse effects on rare or endemic species, which could result in listing under state or federal endangered species laws.

Land managers for the Malheur National Forest (Forest) propose to suppress, contain, control, and eradicate invasive plants using an integrated approach to treatment methods that includes herbicide mechanical, manual, cultural and biological agents[1]. Currently, we estimate that invasive plants occupy approximately 2,124 acres on the Malheur National Forest. The infestations are broadly distributed, often occurring in areas of high spread-potential (e.g., along roads). It is expected that additional invasive plant sites exist but have not yet been identified, so new invasive plants are likely to be introduced over time.

This DEIS focuses on treatment of invasive plants and restoration of treated sites. It is tiered to the broader scale Pacific Northwest Region Invasive Plant Program Preventing and Managing Invasive Plants FEIS (USDA Forest Service 2005a) along with the accompanying Record of Decision for Invasive Plant Program Management (USDA Forest Service 2005b), herein referred to as R6 2005 FEIS and R6 2005ROD.

Extent of the Primary Target Species and Management Objectives

As of November 2012, we estimate that 2,124 acres currently need to be treated within the Malheur National Forest. There are 18 primary target invasive species within 3,070 mapped infested sites (GIS polygons). Site-specific integrated treatment objectives and methods (also referred to as common control measures) vary depending on the size and density of the infestation, its location and the target species, and the design features associated with each action alternative. Invasive plants are scattered throughout the infested areas with density ranging from less than 10 percent to 100 percent primary target species.[2]

We assigned preliminary treatment objectives to each of the primary target species depending on its potential negative impacts, the size of infestations, and the values or sensitivity of the infested sites (or adjacent lands). These objectives are subject to change as site conditions change over time. Table S- 1 displays our current treatment objectives for the 18 primary invasive species mapped on the Malheur National Forest. “Eradication” is our highest priority, and “tolerate” represents the lowest

[1] This project-level EIS responds to the need for suppression, containment, control and eradication of 18 primary invasive species currently found on the Malheur National Forest. It also responds to the need to rapidly treat new detections of these or other invasive species found in the future. Our invasive plant management program is comprised of several interrelated aspects, including preventing the introduction, establishment, and spread of invasive plants on and adjacent to the Forest, and working with other agencies and groups to increase program effectiveness. This EIS is tiered to the R6 2005 FEIS, which analyzes other aspects of the invasive plant management program.

[2] This analysis assumes all sites are 100% occupied by invasive species because this variable is subject to rapid change.

priority for integrated treatment and restoration. All other things being equal, we treat highest priorities first. However, many other variables factor into our annual program of work. Below are definitions of our invasive plant treatment objectives. R6 2005 Standards 12 and 13 require that we identify the desired future condition and objectives before implementing integrated treatments.

Eradicate: Eliminate an invasive plant species from a site. This objective generally applies to species that are difficult to control and cover small areas. Some occurrences may be on roadsides (Russian knapweed, squarrose knapweed) and others may occur in intact native vegetation (yellow starthistle, small occurrences of thistles or knapweed, new invaders). This is generally our first priority for treatment.

Control: Reduce the size of the infestation over time; some level of infestation may be acceptable. This objective applies to most of the target species (houndstongue, leafy spurge, perennial pepperweed, St. Johnswort, sulfur cinquefoil, whitetop) and large infestations of thistles and knapweeds. This is generally our second priority for treatment.

Contain: Prevent the spread of the weed beyond the perimeter of patches or infestation areas mapped from current inventories. This objective applies to target species such as reed canary grass and St. Johnswort. This is generally our third priority for treatment.

Suppress: Prevent seed production throughout the target patch and reduce the area coverage. Prevent the invasive species from dominating the vegetation of the area; low levels may be acceptable. This objective applies to target species such as toadflax that would be treated mainly with biocontrol agents. This is generally our fourth priority for treatment.

Tolerate: Accept the continued presence of established infestations and the probable spread to ecological limits for certain species. This category is for species that are so widespread and abundant that other objectives would be extremely difficult to meet. This category includes species such as cheatgrass, medusahead North Africa grass, dandelion, mullein, and bulbous bluegrass. These invasive plants have low priority for treatment and would likely only be treated if they happen to be near one of the primary target species.

Table S- 1. Current treatment objectives for mapped, primary invasive plant species

Target Species Category	Common Name	Spatial Extent (November 2012)		Treatment Objective
		Sites	Acres	
Knapweeds	Spotted knapweed	171	82	Eradicate small isolated sites in ecologically-sensitive areas Control large open sites and linear roadside populations
	Diffuse knapweed	213	74	Eradicate small isolated sites in ecologically-sensitive areas Control large open sites and linear roadside populations
	Russian knapweed	43	4	Eradicate

Target Species Category	Common Name	Spatial Extent (November 2012)		Treatment Objective
		Sites	Acres	
	Squarrose knapweed	3	<1	Eradicate small isolated sites in ecologically-sensitive areas Control large open sites and linear roadside populations
	Meadow knapweed	2	<1	Eradicate small isolated sites in ecologically-sensitive areas Control large open sites and linear roadside populations
Starthistle	Yellow star-thistle	3	1	Eradicate
Thistles	Canada thistle	1,277	1,021	Control
	Bull thistle*	0	0	Eradicate small infestations in ecologically-sensitive areas Control roadside infestations, large open sites and forested sites
	Scotch Thistle	61	23	Eradicate small isolated sites in ecologically-sensitive areas Control large open sites and linear roadside populations
	Musk thistle	13	11	Eradicate small infestations in ecologically-sensitive areas Control roadside infestations, large open sites and forested sites
Roadside Species	Common St. Johnswort	185	120	Contain
	Houndstongue	171	340	Control
	Sulphur cinquefoil	61	186	Control
Toadflax	Dalmatian toadflax	666	155	Suppress
	Yellow toadflax	27	9	Suppress
Mustards	Whitetop	148	85	Control
	Perennial pepperweed	12	2	Control
Spurge	Leafy spurge	14	10	Control
Total		3,070	2,124	

*Bull thistle and Canada thistle were cataloged together in our November 2012 invasive plant inventory. However, the precise species would be identified to determine the specific treatment objective for a given site.

The underlying purpose of treating invasive plant infestations is 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.

Integrated Control Measures

Table S- 2 lists the integrated control measures effective for the 18 primary target species currently mapped on the Malheur National Forest. The first-choice herbicide is the one that is considered most effective for each target species. Other effective herbicides and integrated treatment methods may also be used, depending on the location of the infestation and the design of each action alternative.

Table S- 2. Common control measures

Primary Target Species	First-Choice Herbicide	Other Effective Herbicides	Integrated Treatment Notes
Yellow star-thistle *Centaurea solstitialis* (CESO3) Annual	aminopyralid	clopyralid glyphosate picloram	Early detection and treatment increase the chances of control. Treatment of small infestations in otherwise healthy sites should be a priority Biological control agents are available. Hand pull when soil is moist and remove all roots and flower and seed heads.
Common St. Johnswort *Hypericum perforatum* (HYPE) Perennial with stolons and rhizomes	aminopyralid	glyphosate metsulfuron methyl picloram	Biological agents are available. Small infestations may be controlled by pulling or digging. Repeated treatments will be necessary because lateral roots can give rise to new plants. Bag and remove all plant parts from site.
Sulphur cinquefoil *Potentilla recta* (PORE5) Taprooted perennial that may have several shallow, spreading branch roots but not rhizomes	metsulfuron methyl	glyphosate picloram triclopyr	Cultural treatments such as seeding of native plants may be effective. There are no approved biocontrols. Small infestations may be controlled by hand digging if the entire root crown is removed. For large infestations, selective herbicides are likely the only method of effective control (TNC 2004). Repeated treatments are needed for the first couple of years to ensure re-establishment does not occur.
Russian knapweed *Acroptilon repens* (ACRE3) Long-lived creeping perennial	aminopyralid	clopyralid chlorsulfuron glyphosate imazapyr metsulfuron methyl picloram	Hand pulling is effective only in the establishment year. Reproduces mainly by vegetative propagation from buds on creeping roots. Biocontrol agents being developed. Cutting or mowing several times per year will control top growth and seed production; re-emerging plants will have less vigor. Lasting control requires an integrated approach; using mechanical or cultural measures with herbicide application, especially in late fall, is most effective. Small, isolated infestations should be eradicated first. Then larger infestations should be controlled from the perimeter and eradicated when possible.

Primary Target Species	First-Choice Herbicide	Other Effective Herbicides	Integrated Treatment Notes
Spotted knapweed *Centaurea stoebe ssp. Micranthos* (CESTM) Taprooted perennial	aminopyralid	clopyralid glyphosate triclopyr picloram	Treatment would focus on reducing seed production and preventing germination. Biological agents are available. Repeated manual pulling and digging may eliminate small infestations (2-4 times per year for multiple years). Pull prior to seed set. Bag and remove flower and seed heads.
Diffuse knapweed *Centaurea diffusa* (CEDI) Short-lived perennial, biennial or annual. Often with a long, stout taproot	aminopyralid	clopyralid glyphosate picloram triclopyr	
Squarrose knapweed *Centaurea ulfome ssp. Squarrosa* (CEVIS2) Taprooted perennial	aminopyralid	clopyralid glyphosate picloram triclopyr	
Meadow knapweed *Centaurea jacea sensulato* (CEJA) Taprooted perennial	aminopyralid	clopyralid glyphosate picloram triclopyr	
Canada thistle *Cirsium arvense* (CIAR4) Rhizomatous perennial	aminopyralid	clopyralid chlorsulfuron picloram	Combining mechanical, cultural, biological, and chemical methods is best for effective control Biological agents are available, but use may affect native thistles. Mowing, cutting or pulling can be an effective control if repeated at about 1-month intervals throughout the growing season for several years. Combining mowing/cutting with herbicides (in the fall) will further enhance control of Canada thistle. Covering with plastic tarp (solarization) may be effective for small infestations.

Primary Target Species	First-Choice Herbicide	Other Effective Herbicides	Integrated Treatment Notes
Bull thistle* *Cirsium vulgare* (CIVU) Taprooted biennial	aminopyralid	clopyralid chlorsulfuron glyphosate picloram triclopyr	Prioritize small infestations in otherwise healthy sites. Prioritize prevention of establishment and eliminating plants as soon as they are found. Biological agents are available, but use may affect native thistles Manually pulling rosettes or cutting stems 2”-4” below the soil surface before flower heads develop kills plants and prevents seed development. Roots may be left on site to dry; all flower and seed heads should be removed. Covering disturbed sites, particularly small burn areas, with fine to medium sized organic matter may prevent or reduce the size of infestations.
Scotch Thistle *Onopordum acanthium* (ONAC) Taprooted biennial or short-lived perennial	aminopyralid	chlorsulfuron clopyralid glyphosate picloram triclopyr	
Musk thistle *Carduus nutans* (CANU4) Taprooted biennial or occasional annual	aminopyralid	chlorsulfuron clopyralid glyphosate picloram triclopyr	
Leafy spurge *Euphorbia esula* (EUES) Rhizomatous perennial	aminopyralid	glyphosate imazapic picloram	Early detection and rapid eradication is important since plant spreads rapidly by seeds and rhizomes. Continuous aggressive management is necessary to keep infestations under control (5 – 10 years). Prioritizing treatment of small infestations, then treating large infestations from the outside edges is most effective. Biological control agents may reduce aboveground stems but do not kill root systems. Mechanical, cultural, or herbicide methods alone are rarely effective. Combinations of several herbicide treatments and planting grass seed may provide the best chance of controlling the species. Hand pulling and grubbing are not effective

Primary Target Species	First-Choice Herbicide	Other Effective Herbicides	Integrated Treatment Notes
			because of the extensive root system. Cutting and mowing reduce seed production and the plant's competitive ability. Covering with weed cloth, plastic, or thick mulch may kill plants. Site can then be planted with native seed. If manual methods are used all plant parts should be bagged and removed since new plants may form from roots and rhizomes as well as from seeds. Plant's milky sap may be irritating to skin, eyes, and digestive tract of humans and other animals.
Houndstongue *Cynoglossum officinale* (CYOF) Taprooted biennial or short-lived perennial	chlorsulfuron	metsulfuron methyl imazapic	Mowing/cutting second year plants during flowering, but before seed maturation reduces seed production and may kill the plant. Pulling plants or cutting 1 – 2 inches below the soil surface have the best chance of eliminating plants. Cutting produces less ground disturbance than pulling. Bag and remove all flower and seed heads.
Dalmatian toadflax *Linaria dalmatica* (LIDA) Perennial with taproot and extensive system of lateral roots	chlorsulfuron	metsulfuron methyl imazapic picloram	Dalmatian toadflax reproduces primarily by seed and partly by adventitious root buds. Yellow toadflax reproduces primarily by adventitious root buds on lateral roots. Biological agents are available and may be very effective. Manual pulling and digging may not be effective because of the deep (4-10 feet) and laterally extensive root systems (to 10 feet from plant). If manually removed, all roots and flower and seed heads should be bagged and removed. Cutting stems in spring or early summer would eliminate seed production, but not the root system. If biocontrol agents continue to be effective, herbicide application may not be needed.
Yellow toadflax *Linaria vulgare* (LIVU2) Perennial with taproot and extensive system of vertical and creeping lateral roots	chlorsulfuron	metsulfuron methyl imazapic picloram	
Whitetop *Cardaria draba* (CADR)	chlorsulfuron	metsulfuron methyl glyphosate imazapic	These species are difficult to control because of its deep taproots (9 ft.) and ability to sprout from root fragments. Early detection and proactive management

Primary Target Species	First-Choice Herbicide	Other Effective Herbicides	Integrated Treatment Notes
Rhizomatous perennial		imazapyr	is most effective since established infestations are difficult to control.
Perennial pepperweed *Lepidium latifolium* (LELA2) Perennial with rhizome like creeping roots			Frequent monitoring for new sites and prioritizing small infestations in otherwise healthy sites is important.. Next priority would be for corridors such as waterways and irrigations structures that have a high likelihood of spread. Biological controls are not available. Repeated pulling may control small, young infestations. Established plants are likely to resprout from deep roots. All roots and flower and seed heads should be removed. Mowing does not eliminate plants but removes thatch.

Alternatives

This EIS discloses the direct, indirect, and cumulative environmental impacts that would result from the proposed action and alternatives.

Four alternatives are considered:

Alternative A, the no-action alternative —If alternative A is selected, no invasive plant treatments would be authorized under this environmental impact statement. Invasive plant treatments would likely continue on state road rights-of-way and easements within the Malheur National Forest because they are not subject to Forest Service control.

Prevention measures, continued to be applied during land uses, would slow (but not stop) the spread of invasive plants on the Forest and surrounding lands given the propagule pressure and type of expected disturbance associated with surrounding land uses and activities.

Alternative A addresses some public concerns by eliminating most herbicide use on the Forest. There would continue to be low or no risks or impacts from herbicides on human health, nontarget vegetation and pollinators, soils, water, aquatic organisms, or wildlife. However, the threats to the environment from invasive plants would continue unabated. Neighbors would continue to be frustrated in their attempts to enlist the Forest Service to help with partnerships to implement effective integrated treatments within and outside Forest boundaries.

Alternative B, the proposed action—This alternative is the most cost-effective approach to invasive plant treatment while minimizing the adverse effects of treatment. Alternative B responds to the purpose and need for action by authorizing several herbicide and other integrated treatment methods to be implemented on the Forest over the next 5 to 15 years. These options are intended to effectively reduce the size and density of invasive sites and abate the adverse effects of invasive plants. The project would continue to be implemented each year until the treatments were no longer needed or conditions substantially change on the ground to such a degree that the analysis in this EIS is no longer valid. The annual implementation planning process discusses how changed conditions would be evaluated for this project over time.

Under alternative B, the herbicide ingredient considered most effective (table S- 2) would be applied the first year of treatment. Over time, other effective herbicides may also be used depending on treatment results.

We are proposing a Land and Resource Management Plan (LRMP) amendment to add aminopyralid to the list of acceptable herbicides for use as part of the integrated treatment toolbox for invasive plants on the Malheur National Forest. Aminopyralid (also known by the trade name: milestone®) was not available during the analysis process for the R6 2005 FEIS. A risk assessment completed in 2007 indicates that this herbicide will increase treatment effectiveness and decrease risk of adverse effects as compared to other herbicides authorized in the R6 2005 ROD. Thus, we propose to add aminopyralid to the list of approved ingredients in invasive plant standard 16 for the Forest (non-significant LRMP amendment). All other standards and guidelines for invasive plant management would remain the same.

We propose to apply aminopyralid to about 64 percent of the infested acreage for the first treatment entry (about 1,350 acres). We would use aminopyralid for the first year of treatment because it is considered the most effective of the proposed herbicides for 13 of the 18 primary target species (all except houndstongue, toadflax, pepperweed and whitetop, which have chlorsulfuron as the first-choice herbicide; and sulphur cinquefoil, that has metsulfuron methyl as the first-choice herbicide) (table 8). Aminopyralid has low toxicity to aquatic organisms and is labeled for use up to the edge of surface waters. Alternative B would allow broadcasting (boom spraying) of this herbicide to the edge of streams and other water bodies.

We are also proposing to use chlorsulfuron for the first treatment entry on 28 percent of the acres (about 591 acres), and metsulfuron methyl for one target species: sulphur cinquefoil that covers an estimated 8 percent of the acres (about 186 acres).

Under alternative B, biological control agents would be deliberately redistributed to suppress or contain established populations of invasive plants on the Forest. Redistribution or release of biological control agents would be done as part of the Oregon Department of Agriculture Biological Control Program and meet the requirements of R6 2005 ROD Standard 14. The treated areas would continue to be inventoried and monitored to determine the success of the treatments, and when the released biological control agents have reached equilibrium with the target species. This EIS is tiered to the R6 2005 FEIS and various and ongoing Animal and Plant Health Inspection Service (APHIS) National Environmental Policy Act (NEPA) documents for the release of biological control agents.

Alternative B provides for treatment flexibility and early detection and rapid response by providing a method for us to adapt to changes on the ground over time. We expect some populations to increase and others to decrease over the life of this project, depending on many unpredictable factors such as weather (droughts and wet periods), funding, and the location of wildland fires or other uncontrolled disturbances. Under alternative B we will tailor the prescription to ground conditions at the time of treatment.

In addition, new or previously undiscovered infestations could be treated using the range of methods described in this EIS. An EDRR approach is needed because (1) the precise location of individual target plants, including those mapped in the current inventory, are subject to rapid and/or unpredictable change, and (2) the typical NEPA process does not allow for rapid response to new detections; infestations may grow and spread into new areas during the time it usually takes to prepare NEPA documentation. The intent of the project early detection and rapid response approach is to treat new infestations when they are small so that the likelihood of adverse treatment effects is minimized. If alternative B is selected, integrated treatments would be authorized for new infestations detected over the next 5 to 15 years, using the treatment methods and project design

features evaluated in this EIS. The analysis of alternative B assumes that all of the current infestations are treated in a single year and all pdfs are properly applied.

Alternative B responds to public concerns about treatment effectiveness by authorizing a wide range of integrated treatment methods that would be prioritized, planned and implemented in cooperation with our neighbors. We would start to use herbicides and redistribute biological control agents on the Malheur National Forest as soon as practicable after the NEPA decision. Alternative B is, by definition, the most cost-effective alternative.

Alternative B favorably responds to issues about effects of herbicides on human health, non-target vegetation and pollinators, soils, water, aquatic organisms, and wildlife because treatments would be implemented according to design features and herbicide-use buffers that minimize the risk of adverse effects.

Two action alternatives were developed in response to public issues related to herbicide use:

Alternative C, strict limitations on herbicide use—This alternative was developed in response to some public concerns about herbicide use on the Malheur National Forest. Alternative C would impose strict limitations on our ability to use herbicides to treat invasive plants. Compared to alternative B, alternative C would further address public issues about herbicide impacts to human health, non-target vegetation and pollinators, soils, water, aquatic organisms, and wildlife, while still allowing for some limited herbicide use. Under alternative C, all of the alternative components for alternative B would be followed, however, no broadcasting of (boom spraying) would be allowed. No herbicide use would be allowed within the boundaries of any mapped infested area that at any point is within 100 feet of creeks, lakes, ponds and wetlands; or 200 feet of well-source areas. Non-herbicide methods would continue to be used within these areas. Picloram would be eliminated from the list of available herbicides. About 735 acres would be approved for spot/selective herbicide use and on the remaining 1,389 acres, no herbicide would be used.

Alternative D, no forest plan amendment and no aminopyralid—This alternative was developed to evaluate the tradeoffs involved with amending the LRMP to add aminopyralid to the list of available herbicides. Some members of the public have expressed doubt about whether or not this herbicide should be approved. Alternative D would be similar to alternative B, except a Forest Plan amendment would not be completed and aminopyralid would not be approved for use on the Malheur National Forest. Aminopyralid would not be used to treat known sites or new detections. Compared to alternative B, more chlorsulfuron, glyphosate, metsulfuron methyl, and picloram would be used in lieu of aminopyralid. As a result, infested sites close to streams and other water bodies would be spot treated rather than broadcast.

Alternative Comparison

Project Design Features and Herbicide-use Buffers

The project design features (pdfs) (table 9) minimize the potential impacts of invasive plant treatment. These pdfs provide sideboards for treatment of known sites, along with new detections. The pdfs were developed to respond to the site-specific resource conditions within the infested areas, including (but not limited to) botanical areas; habitat and presence of botanical, wildlife and/or fish species of conservation concern; the potential for herbicide delivery to water, and proximity other areas of interest (roads and trails, recreation sites, Wilderness/Wild and Scenic Rivers, wildland fire areas). The analysis assumes pdfs are properly implemented. Herbicide-use buffers (table 10 and table 11 restrict the method of application for most of the proposed herbicides depending on their persistence, mobility and toxicity to aquatic organisms and label advisories.

Implementation of pdfs and herbicide-use buffers would be mandatory for all action alternatives, where applicable. Alternative C would not allow broadcasting, so pdfs associated with broadcast treatments would not be applicable. In addition, alternative C would not allow any herbicide use within 100 feet of streams and other water bodies, so the variations in method of application of the different herbicides would not be applicable. Alternative C would eliminate use of picloram so pdfs and herbicide-use buffers associated with picloram would not be applicable.

Alternative D would not amend the Malheur National Forest LRMP so pdfs associated with aminopyralid would not apply.

The following table displays the main differences between the alternatives.

Table S- 3. Alternative comparison by activity

Activity	Alt A (No Action)	Alt B (Proposed Action)	Alt C	Alt D
Authorizes EDRR	No	Yes	Yes	Yes
Non-herbicide treatments	None[3]	Non-herbicide treatments would be integrated with herbicide treatments	Same as Alternative B , except only non-herbicide treatments would be approved within 100 feet of water bodies	Same as Alternative B
Maximum acres of proposed herbicide treatments during any year of implementation	0	2,124	735	Same as Alternative B
Total Invasive Plant Treatment Acres Over the Life of the Project (includes all treatments and re-treatments)	0	30,000 over 15 years (including herbicide use)	11,025 herbicide 30,000 total all treatments	Same as Alternative B
Number of herbicides available for use	0	11	10 (no picloram)	10 (no aminopyralid)
Forest LRMP amendment to include aminopyralid	No	Yes	Yes	No
Herbicide Application Rate and Method	None	Lowest effective rate, broadcast sprayers may be used where needed according to pdfs	Application rate would not exceed 70% of typical broadcast rate, no boom or broadcast sprayers	Same as Alternative B , no aminopyralid

[3] The analysis in chapter 3 assumes that no action means no invasive plant treatments will occur. Prevention would continue, and biological agents distributed in adjacent lands would naturally distribute to host species within the Malheur National Forest.

Table S- 4 displays a comparison of the first year/first choice treatment for each alternative. All action alternatives (B-D) would approve a range of treatments on all 2,124 currently infested acres. Alternative C is the only action alternative that would disallow herbicide use in specific areas to the degree that non-herbicide treatments would be the only methods allowed for a substantial portion of these sites. Under alternative A (no action), no treatments would be approved. Under all alternatives (A-D), approved biological controls will continue to be released adjacent to the project area, and would help suppress toadflax, St Johnswort and other common invasive species. Biological controls would be redistributed to host species within the project area in the action alternatives.

Table S- 4. Comparison of first year/first choice herbicide by alternative

First Year/First Choice Treatment	Alternative A Acres	Alternative B Acres	Alternative C Acres	Alternative D Acres
Broadcast Herbicide Application	0	1,281	0	0
Aminopyralid	0	1,179	0	0
Chlorsulfuron	0	71	0	435
Glyphosate	0	0	0	3
Metsulfuron methyl	0	30	0	69
Picloram	0	0	0	36
Spot/Selective Herbicide Application	0	843	735	1,581
Aminopyralid	0	168	560	0
Chlorsulfuron	0	519	142	595
Glyphosate	0	0	0	722
Metsulfuronmethyl	0	156	33	238
Picloram	0	0	0	27
Non-herbicide Only	0	0	1,389	0

Table S- 5 provides a comparison of the alternatives relative to the issue measures described in chapter 1.

Table S- 5. Alternative comparison relative to significant issues

Issue Component	Unit of Measurement	(No Action) Alternative A	(Proposed Action) Alternative B	Alternative C	Alternative D
1 – Treatment Effectiveness					
Unnecessary restrictions on herbicide use reduce treatment effectiveness and increase treatment costs.	Average Cost per Acre of Effective Treatment (includes re-treatments and restoration)	0	$544	$722	$598
	Total Cost of Most Ambitious Treatment Scenario	0	$1,154,000	$1,472,900	$1,270,500
	Maximum Cost over the Life of the Project (assuming maximum treatment caps multiplied by average per acre cost)	0	$16,320,000	$21,660,000	$17,940,000
	Number of Years to Achieve Objectives (most ambitious treatment scenario)	Objectives not achieved	4 years	6 years	5 years
2 – Herbicide Impacts to Human Health					
Human health may be harmed by herbicide exposure.	Type (rate, method, chemical properties) and extent of herbicide use that could result in harmful exposure scenarios to people.	None	None of the herbicides proposed for use are associated with any harmful scenarios to the public. Where necessary, pdfs minimize or eliminate potential for harmful	Same as Alternative B, except that far less herbicide would likely be sprayed annually. The minimal risks associated with herbicide use under Alternative B would be	Same as Alternative B. Where necessary, pdfs minimize or eliminate potential for harmful exposure scenarios.

Issue Component	Unit of Measurement	(No Action) Alternative A	(Proposed Action) Alternative B	Alternative C	Alternative D
			exposure scenarios by limiting the herbicide ingredient, rate, or method of application in specific areas. Workers need to take specific precautions to avoid harmful herbicide and NPE exposure.	eliminated.	
	Qualitative assessment about the effectiveness of herbicide-use buffers and other project design features to prevent harmful herbicide exposure scenarios	None	Risk assessments demonstrate that aminopyralid poses very low risk to human health. The likelihood of harmful exposures is low, thus the design features have high likelihood of eliminating all potential adverse impacts from herbicide use.	Alternative C would have less risk of herbicide exposure overall, especially to fish and water, due to restrictions on herbicide use near water. The buffers would eliminate all potential herbicide exposure near streams. While this alternative includes some additional design features that would comparatively reduce risk of harmful herbicide exposure, the risk is already low.	Same as Alternative B, except opportunities to use aminopyralid would be foregone and in some cases, higher risk herbicides would be used. However, more spot treatment and less broadcasting would occur, which could result in less herbicide exposure, partly because less herbicide can be applied per day so the daily treatment extent would likely be less. For the project as a whole, the design features minimize adverse impacts to human health from herbicide use.
	Potential for Herbicides to Affect Drinking Water	None	Drinking water quality would not be adversely affected. Restrictions on herbicide use near drinking water and well intakes further minimize risk. Herbicide transportation and handling safety plan would minimize potential	Same as Alternative B	Same as Alternative B

Issue Component	Unit of Measurement	(No Action) Alternative A	(Proposed Action) Alternative B	Alternative C	Alternative D
			for an herbicide spill.		
3 – Herbicide Impacts on Non-target Vegetation and Pollinators					
Proposed herbicide use may harm non-target plants and/or pollinators, specifically sensitive and other species of conservation concern, cultural use plants, and special forest products.	Type and extent of herbicide use within 100 feet of botanical special species of conservation concern, cultural use plants, and special forest products.	None	Project design features prohibit broadcast herbicide use within100 feet of sensitive plant populations. Spot applications will be used within 100 feet of sensitive plant populations. Project design features for use of blue dye will alert special forest product gatherers of herbicide spray areas.	Same as Alternative B, less overall herbicide use	Same as Alternative B
4 - Herbicide Delivery to Water and Potential Impacts to Fish					
Proposed herbicide use may result in chemicals reaching streams and other water bodies (through drift, leaching and/or run off) and may adversely fish and their habitat.	Type and extent of herbicide use within 100 feet of streams and other water bodies.	None	Aminopyralid could be broadcast up to the water's edge; however no adverse impacts on fish are expected because the amount of herbicide that could reach streams is below a level that could harm fish. Herbicide-use buffers and other pdfs reduce the rate, extent, or frequency of herbicide use that pose potential risks to fish.	Same as Alternative B, except no herbicides would be used within 100 feet of streams and other water bodies. There potentially could be more sediment from non-herbicide methods required near streams.	Same as Alternative B, except comparatively more use of higher-risk herbicides relative to fish. Project design features minimize risks and differences between alternatives.
	Qualitative Assessment about whether or not, and how fisheries might be affected	No impacts	Water concentrations from site-specific model runs at highest risk sites demonstrate that levels	Same as Alternative B	Same as Alternative B

Issue Component	Unit of Measurement	(No Action) Alternative A	(Proposed Action) Alternative B	Alternative C	Alternative D
			of herbicide that could reach streams and aquatic organisms are at least 3 orders of magnitude less than levels of concern for fish and their habitat. All treatment methods may result in minor amounts of sediment reaching streams.		
6- Herbicide Impacts on Wildlife					
Proposed herbicide use may result in harmful exposure to terrestrial wildlife (specifically species of conservation concern).	Type and extent of herbicide use within specific wildlife habitats for wildlife of conservation concern	None	This alternative has the most broadcasting, but the first-choice herbicides that would be used pose low risk to wildlife.	Spot application of herbicides would occur on 735 acres and the first-choice herbicides pose low risk to wildlife.	First-choice herbicides that pose a low risk to wildlife would be applied on 1,337 acres, whereas moderate to risk first-choice herbicides would be used on 787 acres. Less broadcasting than Alternative B, which reduces risk of drift.
	Risk of HCB (hexachlorobenzene) contamination and effects on raptor eggs	None	No PCBs in first-choice herbicides. Project design features minimize risk to raptors to extremely low level.	Same as alternative B. No picloram eliminates risk.	Picloram is the first-choice herbicide on 63 acres, posing low risk of PCB's; pdfs minimize risk to raptors to extremely low level.
	Narrative assessment about whether or not, and how species of conservation concern and amphibians might be affected	None	First-choice herbicides pose a low risk to wildlife. Project design features restrict timing or application in sensitive habitats and minimize or eliminate likelihood for any species to receive harmful exposure to herbicide or disturbance.	Same as Alternative B, except greater risk of disturbance from non-herbicide treatments.	Same as Alternative B, except less broadcasting and more use of herbicides that pose a comparatively greater risk to wildlife.

Chapter 1. Purpose and Need for Action

1.1 Introduction

Land managers for the Malheur National Forest (Forest) propose to suppress, contain, control, and eradicate invasive plants using an integrated approach to treatment methods that includes herbicides, mechanical, manual, cultural and biological agents[4]. Currently, we estimate that invasive plants occupy approximately 2,124 acres on the Forest. The infestations are broadly distributed, often occurring in areas of high spread-potential (e.g., along roads). It is expected that additional invasive plant sites exist but have not yet been identified, so new invasive plants are likely to be introduced over time.

Invasive plants are defined as "nonnative plants" whose introduction does or is likely to cause economic or environmental harm or harm to human health (Executive Order 13112). Invasive plants are distinguished from other nonnative plants by their ability to spread (invade) into native ecosystems. They spread between National Forest System lands and neighboring areas, affecting all land ownerships.

Invasive plants are currently damaging the ecological integrity of National Forest System (NFS) lands. They are displacing native plants, increasing the potential for soil erosion and potentially destabilizing streams, reducing water quality and the quality of fish and wildlife habitat, and degrading natural areas. Invasive plants can have adverse effects on rare or endemic species, which could result in listing under state or federal endangered species laws.

The Forest Service has prepared this environmental impact statement (EIS) in compliance with the National Environmental Policy Act (NEPA) and other relevant federal and state laws and regulations. This EIS discloses the direct, indirect, and cumulative environmental impacts that would result from the proposed action and alternatives. The document is organized into the following chapters:

- *Chapter 1. Purpose and Need for Action*: This chapter includes information on the background, and purpose of and need for the project. This section also details how the Forest Service informed the public of the proposal and the issues identified through public scoping.
- *Chapter 2: Alternatives, including the Proposed Action*: This chapter provides a more detailed description of the proposed action as well as alternative methods for meeting the need for action. These alternatives were developed based on issues raised by the public and other agencies. This section also provides a summary table of the design components that compares the relative risks and benefits of each alternative.
- *Chapter 3: Affected Environment and Environmental Consequences:* This chapter describes the current condition and the resources that are at risk from invasive plants on the Malheur National Forest. It also details the environmental effects of implementing the proposed action and other alternatives.

[4] This project-level EIS responds to the need for suppression, containment, control and eradication of 18 primary invasive species currently found on the Malheur National Forest. It also responds to the need to rapidly treat new detections of these or other invasive species found in the future. Our invasive plant management program is comprised of several interrelated aspects, including preventing the introduction, establishment, and spread of invasive plants on and adjacent to the Forest, and working with other agencies and groups to increase program effectiveness. This EIS is tiered to the R6 2005 FEIS, which analyzes other aspects of the invasive plant management program.

- *Chapter 4: Consultation and Coordination:* This chapter provides a list of preparers and agencies and people consulted during the development of the environmental impact statement.
- *Chapter 5: Literature Cited and Glossary:* This chapter provides a list of references cited in the document and a list of definitions for technical terms and acronyms.
- *Appendices:* The appendices provide more detailed information to support the analyses presented in the environmental impact statement. A report discussing the distribution and extent of invasive plants across Malheur National Forest watersheds is in Appendix A.

This report is available for review online at http://www.fs.fed.us/nepa/nepa_project_exp.php?project=35614 Site-specific reports addressing botany, soils, hydrology, wildlife, fisheries, range, recreation and archeology; and detailed maps for the project may be found in the project record located at the Malheur National Forest Headquarters located in John Day, Oregon.

1.2 Background

This 2013 project-level DEIS documents the environmental analysis of a proposal to effectively treat invasive plants on the Malheur National Forest. On June 26, 2000, the Forest first decided to treat weeds using herbicides and other methods according to regional direction developed during the 1980s. However, later that year, the Decision Notice and Finding of No Significant Impact for the Noxious Weed Control Project on the Malheur National Forest were litigated.

In December 2002, U.S. District Court (*Blue Mountain Biodiversity Project v. US Forest Service*, CV 01-703-HA) concluded that the noxious weed control environmental assessment was insufficient under NEPA because it was tiered to earlier documents that the court deemed to be outdated. Thus, we were: "…enjoined from implementing … the use or application of herbicides and biological controls until and unless it considers, evaluates and discloses in an environmental impact statement or supplemental environmental impact statement the individual and cumulative impacts of herbicide use..." (ibid.). Although that court decision applied exclusively to the Malheur National Forest, in 2005 the Pacific Northwest Region 6 Regional Forester decided to amend all of the Forest Plans in the Region based on new herbicide risk assessments and information about preventing invasive plant introduction, establishment and spread, and restoring treated sites.

Management direction for invasive plant prevention, treatment and restoration, and monitoring was added to the Malheur Forest Plan as a result of the Record of Decision for the Pacific Northwest Region Invasive Plant Program: Preventing and Managing Invasive Plants (USDA Forest Service 2005b). This document, referred to herein as the R6 2005 ROD, described the reasons why specific management direction was adopted and why alternative strategies (to increase herbicide use or increase emphasis on prevention) were not adopted. These discussions are summarized and incorporated where relevant; however the decisions made in 2005 are not being reconsidered here. The action alternatives considered in this EIS are intentionally limited in scope to options for implementing updated, effective invasive plant treatments in accordance with the R6 2005 ROD.

The R6 2005 FEIS satisfied the intent of the 2002 court order. On March 31, 2006, the Malheur National Forest published a Notice of Intent (NOI) to prepare an Environmental Impact Statement (EIS) for an invasive plant treatment project (Federal Register Vol. 72, No. 62, pp. 16281 -1628). The Forest Service considered public scoping input and initiated an analysis. However, there was a delay in completing the NEPA process, so the proposed action was updated

and a new NOI was published in the Federal Register on April 5, 2011, (Federal Register Vol. 76, No.65, pp. 18713-18715) initiating new scoping input. Scoping input from both 2006 and 2011 was used to develop issues and alternatives analyzed for this DEIS. We have continued to collect, update and analyze site-specific information during the time since the court injunction.

In accordance with the injunction, we have been treating invasive plants exclusively using manual or mechanical methods on the Malheur National Forest.[5] Manual and mechanical treatments are labor intensive and tend to be costly, and in some cases are not effective (see common control measures table 8 in chapter 2 for more information).

1.3 Project Area

The project area encompasses the entire 1,459,422-acre Malheur National Forest and 240,000 acres of the Ochoco National Forest that are managed by the Malheur Forest (previously known as the Snow Mountain Ranger District, now managed as part of the Emigrant Creek Ranger District.) for a total of nearly 1.7 million acres located in eastern Oregon (figure 2). These 1.7 million acres is the acreage considered as the Malheur National Forest for purposes of this analysis. The main counties included in the analysis area are Grant, Baker and Harney. Small portions of Crook and Malheur Counties are also included in the analysis. The Malheur National Forest shares boundaries with the Umatilla, Wallowa-Whitman and Ochoco National Forests, Bureau of Land Management (BLM), State, county and private lands.

The following map shows the current extent and distribution of invasive species mapped across the project area. The acreage within each 5th field watershed is color-coded; the darker the color indicates more acreage in that watershed.

[5] Herbicides have been used in spot treatments totaling 10-20 acres/year along roads on the Snow Mountain Ranger District portion of the Emigrant Creek Ranger District – Ochoco National Forest, as authorized under the Ochoco National Forest Plan Amendment # 16, which is outside the area covered by the injunction. Biological agents have been released by county and state agencies adjacent to the Malheur National Forest boundaries and are active on widespread host species such as toadflax and St Johnswort within the Forest.

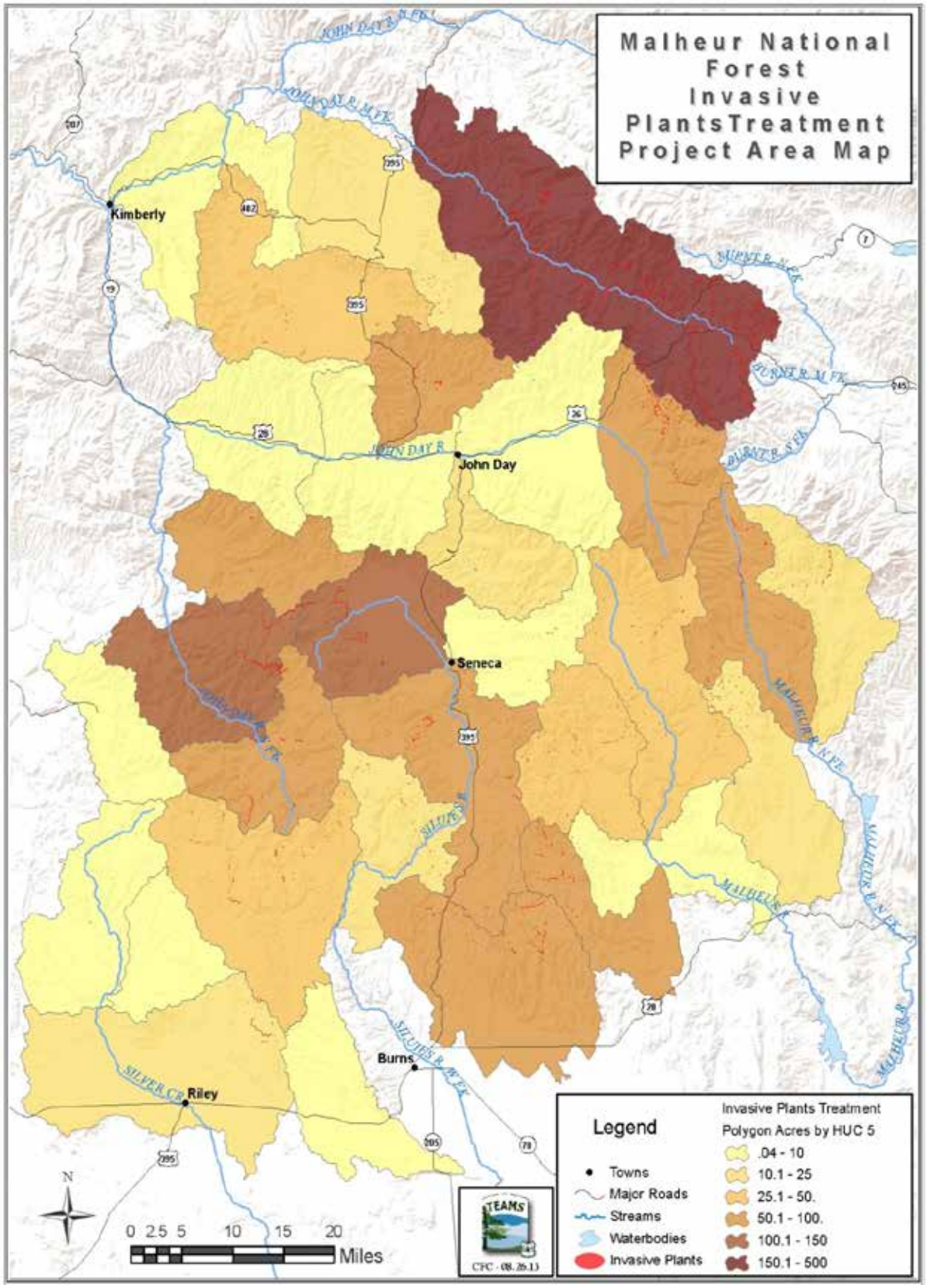

Figure 2. Malheur National Forest project area map with infestations

1.4 Desired Future Conditions

The R6 2005 ROD added the following desired future condition statement to the Malheur National Forest Plan:

> "....healthy native plant communities remain diverse and resilient, and damaged ecosystems are being restored. High quality habitat is provided for native organisms throughout the [Forest]. Invasive plants do not jeopardize the ability of the [Malheur] National Forest to provide goods and services communities expect. The need for invasive plant treatment is reduced due to the effectiveness and habitual nature of preventative actions, and the success of restoration efforts."

The R6 2005 ROD provided management direction intended to help forests reach this desired condition. All projects must include invasive plant prevention measures to meet the R6 2005 ROD standards that amend the Malheur National Forest Land and Resource Management Plan (LRMP). Invasive plant treatments must be timely and may require several years of effort to be effective. Restoration of native plant communities through mulching, seeding or planting may be needed to discourage reinvasion. The Forest needs the ability to implement treatment actions to more effectively contain and reduce the extent of invasive plants at existing inventoried sites, and rapidly responds to new or expanded invasive plant sites as they may occur in the future.

Each of the resource areas addressed in chapter 3 is associated with specific Forest Land and Resource Management Plan management direction, including desired conditions.

1.5 Purpose and Need

The Forest estimates at this time (using our updated inventory), approximately 2,124 acres of invasive plants need to be suppressed, contained, controlled or eradicated. We propose to treat invasive plants using integrated treatment methods in cooperation with our neighbors and in accordance with current management direction, to reduce the extent and impact of invasive plants. The underlying purpose of treating invasive plant infestations is 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.

As discussed previously, invasive plants are occupying many special places on the Forest, including dispersed and developed recreation sites, wilderness areas and wild and scenic river corridors, fish habitat, and grazing allotments. The quality of native plant and wildlife habitats are being degraded across many watersheds on the Malheur National Forest (figure 2).

The lack of sufficient herbicides approved by the R6 2005 ROD for treating invasive plants is hampering the Forest's ability to meet the desired condition described previously. A Malheur National Forest Land and Resource Management Plan Amendment is needed to add aminopyralid to the list of herbicides available for use on the Forest.

Our ability to prevent or minimize adverse impacts of invasive plants is greatest when populations are treated while still small and in early stages of invasion. Treatment options and the likelihood of their success are also greater in small or new invasive populations. Additional benefits of timely treatments include reduced treatment costs and less ground and habitat disturbance.

Invasive plants are estimated to be spreading at an average rate of 8-12 percent; emphasis on prevention may be reducing this rate (potentially to as low as 4 percent per year), but new

infestations are inevitable (R6 2005 FEIS and ROD). Chapter 3.1.5 includes further discussion about vectors for invasive plant spread.

Invasive plant spread is unpredictable and actual locations of target species may change abruptly over time. Accordingly, the Forest needs the flexibility to adapt to changing conditions, and rapidly respond to invasive plant threats that may currently be unknown. Timeliness of action is an important factor because the cost, difficulty, and potential adverse effects of controlling invasive plants increases with the size and extent of the population. The smaller the population when treated, the more likely the treatment will be effective. The Forest needs a way to effectively treat invasive plants as soon as possible after they are detected.

1.6 Proposed Action

The Forest Service proposes an integrated approach to treatments to suppress contain, control, or eradicate invasive plants. That is, treatments would be a combination of herbicides, biological agents, mechanical and manual techniques. Cultural/restoration treatments such as mulching, competitive seeding, or planting with native species would be implemented when needed to facilitate natural plant recovery. Existing and new infestations would be treated, including potential new target invasive plant species that currently are not found on the Forest. The Forest Plan would be amended to provide for the use of the herbicide aminopyralid that was not available when the R6 2005 ROD was signed in 2005. For a full description of the proposed action (alternative B), please see chapter 2.

1.7 Management Direction

This EIS process and documentation has been completed according to direction contained in the National Forest Management Act (NFMA), the National Environmental Policy Act (NEPA), the Council on Environmental Quality (CEQ) regulations, and the Clean Water Act and Endangered Species Act. The project is consistent with all applicable Federal, State and local laws. This EIS tiers to the Malheur National Forest Land and Resource Management Plan Final Environmental Impact Statement and Record of Decision (1990) and incorporates by reference the accompanying Land and Resource Management Plan (LRMP, Forest Plan) (1990), as amended by the Inland Native Fish Strategy (INFISH 1995a) and the Interim Strategies for Managing Anadromous Fish Producing Watersheds (PACFISH 1995), where appropriate, also the Pacific Northwest Region Invasive Plant Program: Preventing and Managing Invasive Plants Final Environmental Impact Statement and Record of Decision for the Pacific Northwest Region Invasive Plant Program: Preventing and Managing Invasive Plants (USDA Forest Service 2005a, USDA Forest Service 2005b).

The Federal Noxious Weed Act of 1974, as amended (7 U.S.C. 2810 et seq.) requires cooperation with State, local and other Federal agencies in the application and enforcement of all laws and regulations relating to management and control of noxious weeds (a summary of this act can be viewed at: http://ipl.unm.edu/cwl/fedbook/fedweed.html\). This Act directs the Secretary of Agriculture 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, to establish and adequately fund the program, to complete and implement the cooperative agreements and/or memorandums, and to establish Integrated Weed Management to control or contain species identified and targeted under cooperative agreements and/or memorandums.

In 2011, the Chief of the Forest Service authorized Forest Service Manual 2900 (FSM 2900) for invasive species management. This project is consistent with this manual direction, which

emphasizes integrated weed management (IWM) concepts and early detection and rapid response (EDRR).

1.7.1 Land and Resource Management Plan

Management direction for the treatment of invasive plants on the Malheur National Forest is specifically provided by the Malheur National Forest Land and Resource Management Plan (LRMP) (1990) as amended by the R6 2005 ROD. The R6 2005 ROD provided management direction for (1) public education and coordination, (2) prevention of the spread of invasive plants during land uses and activities, (3) treatment of target species, (4) reducing reliance on herbicides over time, and (5) site restoration.

The standards that apply to invasive plant treatment/restoration are shown in table 1. Standards related to invasive plant prevention are not duplicated here; all projects on the Malheur National Forest include measures to prevent or slow the spread of invasive plants, such as:

- Timber sale and other contracts require washing heavy equipment
- Weed-free feed requirements in wilderness, later throughout national forests
- Weed-free rock source requirements
- Coordination between road maintenance and invasive plant staff to ensure prevention practices are incorporated into road work
- All project plans require invasive plant prevention measures to be included
- Invasive plant prevention measures are included in special use permits and grazing allotment management plans

Table 1. R6 2005 Standards and Project Compliance

Standard #	R6 2005 Standard (LRMP)	Project Implementation Notes
11	Prioritize infestations of invasive plants for treatment at the landscape, watershed or larger multiple forest/multiple owner scale.	The highest priority infestations are those we can eradicate. Treatments to contain larger, well established populations are lowest priority. Areas where we can reduce the density of invasive plant populations but not entirely eradicate them have medium priority.
12	Develop a long-term site strategy for restoring/revegetating invasive plant sites prior to treatment.	The long-term strategy for restoration depends on the type of site infested, the target species, and location.
13	Native plant materials are the first choice in revegetation for restoration and rehabilitation where timely natural regeneration of the native plant community is not likely to occur. Non-native, non-invasive plant species may be used in any of the following situations: 1) when needed in emergency conditions to protect basic resource values (e.g., soil stability, water quality and to help prevent the establishment of invasive species), 2) as an interim, non-persistent measure designed to aid in the re-establishment of native plants, 3) if native plant materials are not available, or 4) in permanently altered plant communities. Under no circumstances will	Revegetation (competitive seeding and planting) would occur as needed to replace invasive plants with native plant communities. Non-native, non-persistent species may be used infrequently as an interim measure to control erosion or prevent target species from returning on treated sites. Restoration of native plant communities through mulching, seeding or planting would be considered as a follow up to invasive plant treatment.

Standard #	R6 2005 Standard (LRMP)	Project Implementation Notes
	non-native invasive plant species be used for revegetation.	
14	Use only USDA Animal and Plant Health Inspection Service (APHIS) and state-approved biological control agents. Agents demonstrated to have direct negative impacts on non-target organisms would not be released.	Agents found to have negative impacts may not be distributed on the Forest. The R6 Regional Office updates the list regularly.
15	Application of any herbicides to treat invasive plants will be performed or directly supervised by a state or federally licensed applicator. All treatment projects that involve the use of herbicides will develop and implement herbicide transportation and handling safety plans.	The elements of herbicide transportation and handling safety plans discussed in the project design feature section of chapter 2.
16	Select from herbicide formulations containing one or more of the following 10 active ingredients: chlorsulfuron, clopyralid, glyphosate, imazapic, imazapyr, metsulfuron methyl, picloram, sethoxydim, sulfometuron methyl, and triclopyr. Mixtures of herbicide formulations containing 3 or less of these active ingredients may be applied where the sum of all individual Hazard Quotients for the relevant application scenarios is less than 1.0. All herbicide application methods are allowed including wicking, wiping, injection, spot, broadcast and aerial, as permitted by the product label. Chlorsulfuron, metsulfuron methyl, and sulfometuron methyl will not be applied aerially. The use of triclopyr is limited to selective application techniques only (e.g., spot spraying, wiping, basal bark, cut stump, injection). Additional herbicides and herbicide mixtures may be added in the future at either the LRMP or project level through appropriate risk analysis and NEPA/ESA procedures.	No aerial treatment is proposed in any alternative. A Forest Plan amendment would accompany a decision to add aminopyralid to the list of available herbicides.
18	Use only adjuvants (e.g. surfactants, dyes) and inert ingredients reviewed in Forest Service hazard and risk assessment documents such as SERA, 1997a, 1997b; Bakke, 2002.	Adjuvants and inert ingredients would be from approved lists (see chapter 3.1 for more information on adjuvants).
19	To minimize or eliminate direct or indirect negative effects to non-target plants, terrestrial animals, water quality and aquatic biota (including amphibians) from the application of herbicide, use site-specific soil characteristics, proximity to surface water and local water table depth to determine herbicide formulation, size of buffers needed, if any, and application method and timing. Consider herbicides	Chapter 3 discusses how risks from herbicide use are abated by project design features, including buffers and restrictions on herbicide use and method of application near botanical species of local interest, certain wildlife habitats, streams and other water bodies.

Standard #	R6 2005 Standard (LRMP)	Project Implementation Notes
	registered for aquatic use where herbicide is likely to be delivered to surface waters.	
20	Design invasive plant treatments to minimize or eliminate adverse effects to species and critical habitats proposed and/or listed under the Endangered Species Act. This may involve surveying for listed or proposed plants prior to implementing actions within unsurveyed habitat if the action has a reasonable potential to adversely affect the plant species. Use site-specific project design (e.g. application rate and method, timing, wind speed and direction, nozzle type and size, buffers, etc.) to mitigate the potential for adverse disturbance and/or contaminant exposure.	Chapter 3 discusses how potential adverse effects to Endangered Species and critical habitats from herbicide use are minimized.
21	Provide a minimum buffer of 300 feet for aerial application of herbicides near developed campgrounds, recreation residences and private land (unless otherwise authorized by adjacent private landowners).	No aerial application is proposed.
22	Prohibit aerial application of herbicides within legally designated municipal watersheds.	No aerial application is proposed.
23	Prior to implementation of herbicide treatment projects, National Forest staff will ensure timely public notification. Treatment areas will be posted to inform the public and forest workers of herbicide application dates and herbicides used. If requested, individuals may be notified in advance of spray dates.	Chapter 2 lists Project Design Features, including public notification requirements.

The Malheur National Forest LRMP outlines various management areas across the Forest and specific environmental standards and guidelines for each area. Table 2 displays the infested acreage within each management area. In some cases, there is management direction specifically related to invasive plant treatments. Please note that our GIS (Geographical Information System) queries take in more riparian acres than is allocated to this management area. Specific guidance for this management area applies whether or not the acres show up in this database layer.

Table 2. Infested acres

Forest Plan Management Area (MA)	Infested Acres	MA Guidance Related to This Project
Big Game Winter Range Maintenance	172.3	
General Forest	6.4	
General Forest-Rangeland	720.3	
Long Creek Municipal Supply Watershed	0.1	R6 2005 ROD (Forest LRMP) standards do not allow aerial spraying in municipal watersheds. The low level of current infestation likely will not require any use of herbicides.

Forest Plan Management Area (MA)	Infested Acres	MA Guidance Related to This Project
Monument Rock Wilderness	1.1	No mechanical equipment or motorized access allowed
Old Growth	342.1	
Old Growth-District 4-18	0.0	
Research Natural Area	0.1	The Forest Supervisor is responsible to “protect research natural areas” (FSM 4063.04b). FSM 4063.3 requires remove exotic plants or animals to the extent practicable.” Treatments within RNAs are coordinated with the Pacific Northwest Research Station.
Riparian Areas (Anadromous and Non-Anadromous)	239.9	PACFISH-INFISH S&Gs: Treatments in riparian habitats designed to follow riparian management objectives.
Scenic Area	0.5	
Semi-Primitive Non-Motorized Recreation Areas	4.1	
Strawberry Mountain Wilderness	420.0	No mechanical equipment or motorized access allowed.
Visual Corridors (Foreground)	194.4	
Visual Corridors (Middleground)	1.5	
Visual Corridors (Partial Retention)	2.7	
Visual Corridors (Retention)	1.0	
Wild and Scenic River	1.1	
Wildlife Emphasis Area (With Non-Scheduled Timber Harvest)	0.3	
Wildlife Emphasis Area (With Scheduled Timber Harvest)	16.0	
Winter Range	172.3	

1.7.2 Additional Guidance

Wilderness Act

Invasive plant treatment within wilderness areas must be aimed at preserving or protecting wilderness character. Treatments using mechanized equipment are not generally compatible with wilderness status.

Endangered Species Act

The Forest Service is consulting with the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) to ensure the project would not jeopardize the continued existence of federally listed species (or species proposed or considered candidates for listing).

Clean Water Act

A Clean Water Act (National Pollution Discharge Elimination System - NPDES) permit is required for herbicide use that may directly enter streams. Treatments on small portions of

riparian infestations (currently mapped or detected in the future) may meet the criteria; however the type of infestations currently found on the Malheur National Forest are not riparian dependent. The current mapping is not refined enough to determine whether a permit will ultimately be needed; however, NPDES Pesticide General Permits would be obtained prior to implementing any treatments in which herbicide could be directly introduced into surface waters.

Clean Water Act compliance includes use of best management practices (BMPs). Specific BMPs are required for chemical use on National Forests (National BMP Technical Guide - USDA Forest Service 2012). The project design features in chapter 2 integrate the national BMPs. Core objectives for chemical uses on National Forests are provided in the technical guide. These include:

- 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.
- 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.
- Avoid or minimize the risk of chemical delivery to surface water or groundwater when treating areas near waterbodies.

1.8 Decision to be Made

The Malheur National Forest Supervisor is the responsible official for this EIS and will make the following decision:

- Whether or not to authorize site-specific invasive plant treatments using herbicides and other methods
- Whether or not to amend the Malheur National Forest LRMP
- Whether or not to implement an early detection and rapid response process for infestations that are detected over the next 5-15 years
- What project design features are required
- What monitoring will occur

1.9 Public Involvement and Scoping

Ongoing public involvement has occurred throughout this NEPA process. Tribes have been consulted and input from federal and state agencies has been sought. The proposed action was circulated for scoping input in 2006 and again in 2011.

Scoping Respondents in 2011 included: Dick Artley, Karen Coulter, Blue Mountains Biodiversity Project (BMBP), Doug Heiken (Oregon Wild), the Grant Soil and Water District (GSWD), and the National Park Service (NPS).

Scoping Respondents in 2006 included: Karen Coulter (BMBP); Oregon Natural Desert Association (ONDA); Center for Tribal Water Advocacy (CTWA); U.S. Environmental Protection Agency (EPA); Doug Heiken with others Oregon Natural Resource Council (ONRC); Matt Carter; Walt Gentis, Nancy Hafer; Phil Turrell (RMEF); Dan Bishop; Assante Riverwind (Sierra Club); John Day RAC, Jean Public; and Gregg Smith.

The Forest Service reviewed scoping responses and identified issues—points of discussion, debate or dispute about environmental effects—related to the proposed action. Public issues

revolve around the cost-effectiveness of the treatments proposed and the potential adverse effects of herbicide use. The focus on herbicide use is prevalent because other treatments such as manual and mechanical have been authorized for many consecutive years on the Forest, while herbicides have not been applied. Thus, herbicide application is the part of the program that is the focus of alternatives considered herein.

1.10 Issues

The following significant issues influenced the analysis of alternatives in this EIS:

- Treatment cost-effectiveness
- Herbicide impacts to human health
- Herbicide impacts on non-target vegetation and pollinators
- Herbicide delivery to water and impacts on fish
- Herbicide impacts on wildlife

1.10.1 Treatment Cost-Effectiveness

Issue Statement: Unnecessary restrictions on herbicide use reduce treatment effectiveness and increase treatment costs.

Background: Integrated invasive plant treatments need to be timely and cost-effective to be able to result in suppression, containment, control, or eradication of invasive plants. Restrictions on herbicide type, timing, extent, rate, and application method (beyond label restrictions and R6 standards) limit our ability to effectively treat known and new sites. Treatment costs and need for re-treatment are directly affected by the range of effective treatments available in the toolbox for any given site. Increased costs and reduced effectiveness reduce the acreage that can be effectively treated with limited funding. This issue is directly addressed in chapter 3.1.4.

Issue Measures:

- Average cost per acre of effective treatment (includes re-treatments and restoration)
- Total cost of the most ambitious treatment scenario[6]
- Maximum cost over the life of the project (assuming maximum treatment caps multiplied by average per acre cost)
- Years to achieve objectives

1.10.2 Herbicide Impacts to Human Health

Issue Statement: Human health may be harmed by herbicide exposure.

Background: This issue speaks to general concern about herbicides and the risks to workers and the general public from proposed herbicide use. For the most part, by following the management direction for herbicide use from the R6 2005 ROD, which amended the Malheur National Forest LRMP, herbicide use would not result in exposures above conservative thresholds of concern for human health. The risk assessment for aminopyralid demonstrates that this herbicide does not pose additional risks to human health. At the project level, risks are further minimized through

[6] The most ambitious treatment scenario assumes all of the areas that are currently infested with invasive plants are treated the first year after a decision is made for this project, and re-treated as needed to achieve control objectives.

project design features (table 9) and herbicide-use buffers (table 10 and table 11) that avoid certain types of exposures. This issue is addressed in chapter 3.2. Additional information about drinking water sources is in chapter 3.5.

Issue Measures:

- Type (rate, method, chemical properties) and extent of herbicide use that could result in toxic herbicide exposure to people
- Qualitative assessment about the effectiveness of herbicide-use buffers[7] and other project design features to prevent toxic herbicide exposure to people
- Potential for herbicides to affect drinking water

1.10.3 Herbicide Impacts on Nontarget Vegetation and Pollinators

Issue Statement: Proposed herbicide use may harm nontarget plants and/or pollinators, specifically sensitive and other special status species, cultural use plants, and special forest products.

Background: Herbicides are designed to kill plants and there is always a risk that herbicide will affect nontarget botanical species (vascular and non-vascular plants, fungi, algae, lichens, bryophytes, liverworts). The presence of special-status species, treatment extent, rate and method of application and the properties of the chemicals proposed influence the degree of risk. This issue is addressed in chapter 3.3.

Issue Measures:

- Type and extent of herbicide use within 100 feet of botanical species of conservation concern, cultural use plants, and special forest products
- Qualitative assessment about the effectiveness of herbicide-use buffers and other project design features to prevent herbicide from harming nontarget botanical species and pollinators

1.10.4 Delivery to Water and Potential Herbicide Impacts on Fish

Issue Statement: Proposed herbicide use may result in chemicals reaching streams and other water bodies (through drift, leaching and/or run off) and adversely affect fish and their habitat.

Background: The proposed action will minimize potential for herbicide delivery to streams and other water bodies. However, the risk that some chemicals may reach surface waters cannot be eliminated. Treatment extent, rate and method of application and the properties of the chemicals proposed influence the degree of risk. Specific concern about picloram use has been expressed due to its potential mobility and persistence in the soil. The main focus of this issue is the potential for aquatic species of conservation concern. This issue is addressed in chapter 3.5. and 3.6.

- Type and extent of herbicide use within 100 feet of streams and other water bodies
- Qualitative assessment about whether fisheries might be affected and in what way

[7] Herbicide-use buffers are areas near streams and other water bodies where some types of herbicide use are restricted.

1.10.5 Herbicide Impacts on Wildlife

Issue Statement: Proposed herbicide use may result in harmful exposure to terrestrial wildlife (specifically species of conservation concern).

Background: Most of the herbicides proposed for use pose no risk to terrestrial wildlife and amphibians. The focus of this issue is on the herbicides that pose a small risk, meaning that there are some plausible exposure scenarios that exceed the no-effect level. There is limited information about effects on amphibians, so pdfs are in place to add an extra layer of caution to protect these species. Hexachlorobenzene (HCB), an industrial contaminant within picloram, and to a lesser extent, clopyralid, poses potential risks to raptor eggs. This is one reason aminopyralid is the first-choice herbicide between the three, as no HCBs are present in aminopyralid. This issue is addressed in chapter 3.7.

Issue Measures:

- Type and extent of herbicide use within wildlife habitats for wildlife species of conservation concern
- Risk of HCB contamination and effects on raptor eggs
- Narrative assessment about whether, and how wildlife species of conservation concern and amphibians might be affected

1.10.6 Other Issues

Some public concerns expressed in scoping responses are not considered significant issues because they are addressed through routine compliance with management direction, are addressed through tiering to the R6 2005 FEIS, or are addressed by best available science.

Issues Addressed by Compliance with Management Direction

Some public concerns are not considered significant issues for analysis but are routinely addressed in the course of environmental analysis. Compliance with existing management direction, permits and other requirements associated with the action, and disclosure of findings and determinations associated with endangered species act consultation are some of the topics that are covered in this EIS, but are not considered significant issues.

The proposed action will be designed to follow relevant management direction (an LRMP amendment is proposed to allow use of aminopyralid, which is intended to meet other standards requiring that impacts be minimized through site-specific selection of chemicals and other measures). In addition, we are working with tribal governments and others to ensure environmental justice and protection of heritage resources and treaty rights.

Impacts to soils have been resolved through adherence to the R6 2005 ROD standards and additional project design features. None of the alternatives pose significant threats to soils given the nature of the types of treatments proposed. The approach to soils in this document is to analyze how herbicides are filtered through various soil types and their eventual environmental fate, with the main issue ultimately being potential effects on fish.

In addition, we are working with tribal governments and others to ensure environmental justice and protection of heritage resources and treaty rights. The sections on human health, botany and archeology offer more information about these topics.

Issues Addressed by Tiering to the R6 2005 FEIS

Some commenters remarked that changes in land uses and other measures should be applied to forest activities to prevent or slow the spread of invasive plants. Prevention applied to land uses is not a connected action to this project. The R6 2005 FEIS discussed the programmatic relationship between prevention, the spread of weeds, and the eventual need for treatment (chapter 4.1.3). Causes and vectors of invasive plant spread are specifically addressed in the R6 2005 FEIS (chapter 3 and appendices).

This treatment project EIS is tiered to the R6 2005 FEIS and relies on these discussions where necessary to address the relationship between land uses and invasive plant spread. However, at the project level, the need for suppression, eradication, control, and containment of invasive plants will still exist regardless of how the prevention standards from the R6 2005 ROD, along with other management direction, are implemented. The R6 2005 FEIS acknowledges that invasive plants will continue to spread, and treatment will continue to be needed; even with prevention measures applied to land uses (R6 2005 FEIS 4.1.3).

Issues Addressed by Best Available Science

Issues about herbicide toxicity are addressed through peer-reviewed risk assessments and site-specific risk models, which constitute best available science. Some people do not accept the dose-exposure relationship that is part of the risk assessment process, nor do they believe that information supplied by chemical manufacturers is valid. These beliefs are not resolvable in this EIS.

Current science is insufficient to precisely determine a cause-and-effect relationship between climate change and the proposed action for the project area. A general conclusion, based on the preponderance of current literature, suggests that “most of the important elements of global climate change are likely to increase the prevalence of biological invaders” (Bautista 2008). All action alternatives include an early detection/rapid response component to address uncertainties regarding effects of climate change at any specific location over the life of this project.

1.11 What this Proposal Does Not Include

- This action does not include experimental trials of herbicides conducted by the U.S. Environmental Protection Agency (EPA) to test new products.
- This action does not include activities that could influence invasive plant populations but are covered under other programs. Such programs include transportation planning, timber management, livestock grazing, etc. Invasive plant prevention and treatment activities are incorporated into individual projects carried out under regulation and guidance of these programs.
- No treatment of aquatic invasive plants is proposed.
- No aerial herbicide application is proposed.
- No mechanical restoration treatments such as scarification are proposed.

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Chapter 2. Alternatives, Including the Proposed Action

2.1 Introduction

This chapter summarizes and compares four alternatives for invasive plant treatments including the no-action alternative. No action for this environmental impact statement (EIS) is defined as **not** using integrated treatment methods and **not** following updated management direction for invasive plants.

Under alternative A-no action, invasive plant treatments would not be authorized as part of a decision on this project-level EIS; projects similar to the current program would likely be authorized under *categorical exclusions* or *connected actions* associated with other project decisions. Please see the glossary for a definition of categorical exclusions and connected actions. Biological agents would also continue to find their way onto the Malheur National Forest, but none would be deliberately released by Forest personnel. [8] More information about the no-action alternative can be found later in this chapter.

Alternative B-proposed action is the most ambitious and effective conceivable approach to invasive plant treatment. Integrated treatment prescriptions were developed to effectively suppress, eradicate, control, and contain the 18 target species currently found within 2,124 acres (3,070 mapped sites) on the Malheur National Forest. Project design features minimize the possible adverse effects of treatment in accordance with the LRMP for the Malheur National Forest (chapter 1, management direction).

2.2 Extent of the Primary Target Species and Management Objectives

As of November 2012, approximately 2,124 acres containing target invasive plant species have been mapped within the project area (figure 2). There are 18 primary target invasive species within 3,070 mapped infested sites (GIS polygons). Site-specific integrated treatment objectives and methods (also referred to as common control measures) vary depending on the size and density of the infestation, its location and the target species, and the design features associated with each action alternative. Invasive plants are scattered throughout the infested areas with density ranging from less than 10 percent to 100 percent primary target species.[9]

Preliminary treatment objectives were assigned to each of the primary target species depending on its potential negative impacts, the size of infestations, and the values or sensitivity of the infested sites (or adjacent lands). These objectives are subject to change as site conditions change over time. Table 3 displays our current treatment objectives for the 18 primary invasive species mapped on the Malheur National Forest. “Eradication” is our highest priority, and “tolerate” represents the lowest priority for integrated treatment and restoration. All other things being equal, we would treat highest priorities first. However, many other variables factor into the annual program of work. Below are definitions of our invasive plant treatment objectives. R6 2005 Standards 12 and 13 require that we identify the desired future condition and objectives before implementing integrated treatments.

Eradicate: Eliminate an invasive plant species from a site. This objective generally applies to species that are difficult to control and cover small areas. Some occurrences may be on roadsides (Russian knapweed, squarrose knapweed) and others may occur in intact native vegetation (yellow starthistle, small occurrences of thistles or knapweed, new invaders). This is generally the first priority for treatment.

Control: Reduce the size of the infestation over time; some level of infestation may be acceptable. This objective applies to most of the target species (houndstongue, leafy spurge, perennial pepperweed, sulfur cinquefoil, whitetop) and large infestations of thistles and knapweeds. This is generally the second priority for treatment.

[8] Invasive plant treatments would likely continue on state road rights-of-way and easements within the Malheur National Forest because they are not subject to Forest Service control.
[9] This analysis assumes all sites are 100% occupied by invasive species because this variable is subject to rapid change.

Contain: Prevent the spread of the weed beyond the perimeter of patches or infestation areas mapped from current inventories. This objective applies to target species such as and common St. Johnswort. This is generally the third priority for treatment.

Suppress: Prevent seed production throughout the target patch and reduce the area coverage. Prevent the invasive species from dominating the vegetation of the area; low levels may be acceptable. This objective applies to target species such as toadflax that would be treated mainly with biocontrol agents. This is generally the fourth priority for treatment.

Tolerate: Accept the continued presence of established infestations and the probable spread to ecological limits for certain species. This category is for species that are so widespread and abundant that other objectives would be extremely difficult to meet. This category includes species such as cheatgrass, medusahead North Africa grass, dandelion, mullein, and bulbous bluegrass. These invasive plants have low priority for treatment and would likely only be treated if they happen to be near one of the primary target species.

Table 3. Current treatment objectives for mapped, primary invasive plant species

Target Species Category	Common Name	Spatial Extent (November 2012)		Treatment Objective
		Sites	Acres	
Knapweeds	Spotted knapweed	171	82	Eradicate small isolated sites in ecologically-sensitive areas Control large open sites and linear roadside populations
	Diffuse knapweed	213	74	Eradicate small isolated sites in ecologically-sensitive areas Control large open sites and linear roadside populations
	Russian knapweed	43	4	Eradicate
	Squarrose knapweed	3	<1	Eradicate small isolated sites in ecologically-sensitive areas Control large open sites and linear roadside populations
	Meadow knapweed	2	<1	Eradicate small isolated sites in ecologically-sensitive areas Control large open sites and linear roadside populations
Starthistle	Yellow star-thistle	3	1	Eradicate
Thistles	Canada thistle	1,277	1,021	Control
	Bull thistle*	0*	0*	Eradicate small infestations in ecologically-sensitive areas Control roadside infestations, large open sites and forested sites
	Scotch Thistle	61	23	Eradicate small isolated sites in ecologically-sensitive areas Control large open sites and linear roadside populations

Target Species Category	Common Name	Spatial Extent (November 2012)		Treatment Objective
		Sites	Acres	
	Musk thistle	13	11	Eradicate small infestations in ecologically-sensitive areas Control roadside infestations, large open sites and forested sites
Roadside Species	Common St. Johnswort	185	120	Contain
	Houndstongue	171	340	Control
	Sulphur cinquefoil	61	186	Control
Toadflax	Dalmatian toadflax	666	155	Suppress
	Yellow toadflax	27	9	Suppress
Mustards	Whitetop	148	85	Control
	Perennial pepperweed	12	2	Control
Spurge	Leafy spurge	14	10	Control
Total		3,070	2,124	

*Bull thistle and Canada thistle were cataloged together in our November 2012 invasive plant inventory. However, the precise species would be identified to determine the specific treatment objective for a given site.

2.3 Alternatives Considered in Detail

2.3.1 Alternative A – No Action

The no-action alternative is required by NEPA (36 CFR 220) to provide a baseline for comparison of effects of action alternatives. If the no-action alternative is selected for this project, no invasive plant treatments would be authorized. The Malheur National Forest invasive plants treatment program would not follow current invasive plant management direction.

Since 2002, when use of biological agents and chemicals for invasive plant control was enjoined by the court on the Malheur National Forest, most treatments have been manual (primarily hand pulling and digging) with limited mechanical treatment (primarily mowing).

In 2010, the Malheur National Forest treated about 375 acres with manual and mechanical treatments using "Forest Service personnel, County cooperators, and Nature Conservancy volunteers" (R6 2010 accomplishment report). In 2011, the Malheur National Forest treated 203 acres in essentially the same manner (R6 2011 accomplishment report). 2012 saw a drop in manual and mechanical acres accomplished to 39 (R6 2012 accomplishment report). Partners and cooperators in 2012 were the Confederated Tribes of the Warm Springs, Harney County, the Nature Conservancy, Oregon Department of Agriculture, and Oregon Department of Transportation. Our focus in 2012 was working on this Draft EIS.

If alternative A-no action is selected, the Forest Service would not treat invasive plants as proposed in the action alternatives. Invasive plant treatments would likely continue on state road right of ways and easements within the Malheur National Forest because they are not subject to Forest Service control. Any future treatments would require a separate environmental analysis. For example categorical exclusions may be completed to authorize manual and limited mechanical treatments in site specific areas. Prevention measures applied during land uses would continue to slow (but not stop) the spread of invasive plants on the Forest and surrounding lands (see chapter 3.1.5 for more information about the potential for spread of invasive plants over time within the Forest) given the propagule pressure and type of expected disturbance associated with surrounding land uses and activities.

Alternative A addresses some public concerns by eliminating most herbicide use on the Forest. There would continue to be low or no risks or impacts from herbicides on human health, nontarget vegetation and pollinators, soils, water, aquatic organisms, or wildlife. However, the threats to the environment from invasive plants would continue unabated. Neighbors would continue to be frustrated in their attempts to enlist the Forest Service to help with partnerships to implement effective integrated treatments within and outside Forest boundaries.

No biological agents were deliberately released within the Malheur National Forest boundaries, because the 2002 Court Order enjoined the Forest Service from releasing these agents. However, biological agents that have been released in surrounding National Forests and lands of other ownerships disperse to new areas on their own. The analyses of the environmental effects of biological control agents have already been completed under documents developed by Agricultural Plant Health and Insect Service (APHIS) for approval of their use. The completed environmental impact statements are available at: http://www.aphis.usda.gov/ppq/enviro_docs/index.html. These analyses assume the agent may occur throughout the range of its host invasive species.

Therefore, although they have not been released by the Malheur National Forest, biological control agents are helping to suppress or contain established populations of invasive plants here. Common biological agents released on neighboring Forests and adjacent counties and likely already distributed on the Malheur National Forest are displayed in the following table.

Table 4. Biological agents released on neighboring lands

Target Species	Agent	Mode of Action
Canada Thistle	*Ceutorhunchus litura*	Larvae mine pith in stems of flowering plants, increasing susceptibility to pathogens. Adults feed on leaves.
Canada Thistle	*Urophora cardui*	Larvae cause galls on the stems that act as nutrient sinks, stressing plants and reducing seed production and growth.
Dalmation Toadflax	*Mecinus janthinus*	Larvae are stem miners; adults can cause damage to flowers and young leaves.
Leafy Spurge	*Aphthona cyparissiae, Aphthona flava, Apthona nigriscutis*	Adults feed on foliage reducing the plant's production of sugars; larvae feed on root hairs and young roots reducing the plant's ability to take up water and nutrients.
Leafy Spurge	*Aphthona czwalinae, Apthona lacertosa*	Adults feed on foliage reducing the plant's production of sugars; larvae feed on root hairs and young roots reducing the plant's ability to take up water and nutrients.
Leafy Spurge	*Oberea erythrocephala*	Larvae bore in the stems and roots of larger plants. Adults girdle the top of the stalk before laying eggs in the stem.
Mediterranean Sage	*Phrydiuchus tau*	Adults feed on the leaves, and larvae feed in the root crown and petioles of large leaves.
Musk Thistle	*Rhinocyllus conicus*	Larvae eat seeds in primary heads, lateral heads still produce seed
Musk Thistle	*Trichosirocalus horridus*	Larvae feed on the root crown, damaging the primary shoot, and adults feed on the leaves. Large numbers of larvae can kill rosettes.
Musk Thistle	*Urophora solstitialis*	Larvae cause galls in the seed heads that interfere with seed production and dissemination.
Spotted Knapweed	*Cyphocleonus achates*	Larvae are root borers and adults feed on the leaves

Target Species	Agent	Mode of Action
Spotted Knapweed	*Metzneria paucipunctella*	Larvae consume seeds in infested heads.
Spotted Knapweed, Diffuse Knapweed	*Bangasternus fausti*	Attacks the project EISrly buds, and appears to contribute to the impacts of *Larinus minutus*. Larvae consume most of the seeds in infested heads.
Spotted Knapweed, Diffuse Knapweed	*Larinus minutus*	Larvae feed in the flower head destroying most of the seeds. Heavy attack by adults can stunt or kill plants and delay flowering.
St Johnswort	*Chrysolina quadrigemina*	Adults and larvae are foliage feeders.
Yellow Starthistle	*Bangasternus orientalis*	Larvae feed on seeds and seed heads, reducing the number of seeds by 40-60%
Yellow Starthistle	*Chaetorellia australis*	Larvae tunnel into the center of the head, where they feed on the ovaries and developing seeds.
Yellow Starthistle	*Chaetorellia succinia*	Larvae tunnel into the center of the head, where they feed on the ovaries and developing seeds.
Yellow Starthistle	*Eustenophus villosus*	Adults feed on developing buds, causing the buds to die. Larvae feed on the seed head and developing seeds.
Yellow Starthistle	*Larinus curtus*	Adults feed on the flowers and larvae feed on the seed head, reducing seed production.
Yellow Starthistle	*Urophora sirunaseva*	Larvae feed on flowers and seed heads and cause formation of galls.

2.3.2 Alternative B – Proposed Action

Introduction

Alternative B, the proposed action, is our proposal as the most cost-effective approach to invasive plant treatment while minimizing the adverse effects of treatment according to the Malheur National Forest LRMP as amended R6 2005 ROD. We inventoried the invasive plants across the Malheur National Forest and identified common control measures for the 18 primary target species found.

The common control measures include a range of integrated treatment/restoration methods that could be implemented across a range of infested sites. We will identify the specific manual, mechanical, biological, herbicide and cultural/restoration treatments to be implemented at the time of treatment (see common control measures table below).

In addition to the common control measures (table 8), we developed project design features (table 9) and herbicide-use buffers (table 10 and table 11) for alternative B. The project design features and herbicide-use buffers are intended to minimize adverse effects of treatment and follow national Best Management Practice guidelines for chemical uses on national forests (USDA Forest Service 2012).

To develop the common control measures, project design features, and herbicide-use buffers, we considered the best available scientific information about invasive plant management. Our primary sources come from the R6 2005 FEIS, the most current herbicide and adjuvant risk assessments (SERA and Bakke), professional journal articles and other information published since 2005. The literature cited section of chapter 4 documents our commitment to using best available science and high quality data.

Alternative B responds to the purpose and need for action by authorizing several herbicide and other integrated treatment methods to be implemented on the Malheur National Forest over the next 5 to 15 years. These options are intended to effectively reduce the size and density of invasive sites and abate the adverse effects of invasive plants. The project would continue to be implemented each year until the treatments were no longer needed or conditions substantially change on the ground to such a degree that the analysis in this EIS is no longer valid.

The annual implementation planning process later in this chapter (section 2.4.2) discusses how changed conditions would be evaluated for this project over time.

Aminopyralid would be used for the first year or so of treatment for about 1,350 acres (64 percent of the total infested acreage). This herbicide is likely to be the most effective of the 11 available herbicides for 13 of the 18 primary target species (all except houndstongue, toadflax, pepperweed and whitetop, which have chlorsulfuron as the first-choice herbicide; and sulphur cinquefoil, that has metsulfuron methyl as the first-choice herbicide). Other effective herbicides could be used as needed over time, depending on whether the first year's choice proved effective.

Under alternative B, biological control agents would be deliberately redistributed to suppress or contain established populations of invasive plants on the Forest. Redistribution or release of biological control agents would be done as part of the Oregon Department of Agriculture Biological Control Program and meet the requirements of R6 2005 ROD standard 14. The treated areas would continue to be inventoried and monitored to determine the success of the treatments and when the released biological control agents have reached equilibrium with the target species. This EIS is tiered to the R6 2005 FEIS and various and ongoing APHIS NEPA documents for the release of biological control agents. By definition, only agents that have been approved by APHIS would meet the R6 2005 ROD Standard 14. See table 4 for the list of approved biological agents for target species that are currently found on the Forest.

Alternative B responds to public concerns about treatment effectiveness by authorizing a wide range of integrated treatment methods that would be prioritized, planned and implemented in cooperation with our neighbors. We would start to use herbicides and redistribute biological control agents on the Forest as soon as practicable after the NEPA decision. Alternative B is, by definition, the most cost-effective alternative.

Alternative B favorably responds to issues about effects of herbicides on human health, non-target vegetation and pollinators, soils, water, aquatic organisms, and wildlife because treatments would be implemented according to design features and herbicide-use buffers that minimize the risk of adverse effects.

Land and Resource Management Plan Amendment

We are proposing a Land and Resource Management Plan amendment to add aminopyralid to the list of acceptable herbicides for use as part of the integrated treatment toolbox for invasive plants on the Malheur National Forest. Aminopyralid (also known by the trade name: Milestone®) was not available during the analysis process for the R6 2005 FEIS. The risk assessment completed in 2007 (table 7) indicates that this herbicide will increase treatment effectiveness and decrease risk of adverse effects as compared to other herbicides authorized in the R6 2005 ROD. Thus, we propose to add aminopyralid to the list of approved ingredients in invasive plant standard 16 for the Forest (non-significant LRMP amendment). All other standards and guidelines for invasive plant management would remain the same (see chapter 1).

U.S. EPA (2005) has concluded that the use of aminopyralid as a replacement for other herbicides will decrease risk to some non-target species (SERA 2007):

> *"Aminopyralid is a Reduced Risk herbicide that provides reliable control of a broad spectrum of difficult-to control noxious weeds and invasive plants on rangeland and pastures, rights-of-way, and wildlife habitat areas. Aminopyralid is particularly effective for the control of tropical soda apple, musk thistle, Canada thistle, spotted knapweed, diffuse knapweed, yellow starthistle and Russian knapweed. Aminopyralid has a favorable human health toxicity profile when compared to the registered alternatives for these use sites and will be applied at a lower rate. Its residual action should alleviate the need for repeat applications, resulting in a reduction in the amount of herbicides applied to the environment for the control of these weeds. Aminopyralid has been determined to be practically non-toxic to non-target animals at the registered application rates, compared to the alternatives, and is less likely to impact both terrestrial and aquatic plants."*

Currently Standard 16 reads:

> *Select from herbicide formulations containing one or more of the following 10 active ingredients: chlorsulfuron, clopyralid, glyphosate, imazapic, imazapyr, metsulfuron methyl, picloram, sethoxydim, sulfometuron methyl, and triclopyr…Additional herbicides and herbicide mixtures may be added in the future at either the Malheur National Forest LRMP or project level through appropriate risk analysis and NEPA/ESA procedures.*

We propose to amend Standard 16 to read:

> *Select from herbicide formulations containing one or more of the following 11 active ingredients:* ***aminopyralid****, chlorsulfuron, clopyralid, glyphosate, imazapic, imazapyr, metsulfuron methyl, picloram, sethoxydim, sulfometuron methyl, and triclopyr…Additional herbicides and herbicide mixtures may be added in the future at either the Malheur National Forest LRMP or project level through appropriate risk analysis and NEPA/ESA procedures.*

Invasive Plant Treatment Methods Authorized Under Alternative B

The following description summarizes important information about the treatment methods that are proposed for alternative B.

Table 5. Proposed treatment methods descriptions

Treatment Method	Description
Manual	Includes hand pulling or using hand tools (e.g., grubbing), to remove plants or cut off seed heads. Manual treatments are labor intensive, effective only for relatively small accessible areas, and would be repeated several times throughout the growing season depending on the species. Handsaws, axes, shovel, rakes, machetes, grubbing hoes, mattocks, brush hooks, and hand clippers may all be used to manually remove invasive plant species. Other manual methods could include mulching, hot water steaming, or solarization techniques such as using black plastic to cover invasive plants to shade out and kill pieces of roots (i.e. rhizomes). These techniques could be used where minimizing herbicide use is desirable such as streambanks or near sensitive plant populations.
Mechanical	Mechanical methods use power tools and include such actions as mowing, weed whipping, road brushing, and root tilling. These activities would typically occur along roadsides, rock sources, or other confined disturbed areas and dispersed use areas. Mowing and cutting would be used to reduce or remove above ground biomass. Seed heads and cut fragments of species capable of re-sprouting from stem or root segments would be collected and properly disposed of to prevent them from spreading into non-infested areas.
Biological Agents	Biological agents are parasitic insects, mites, nematodes, and pathogens that feed on specific parts of invasive plants and inhibit their growth and spread. In some situations, a suite of biological control agents is needed to reduce weed density to a desirable level. For instance, a mixture of five or more biological control agents may be needed to attack flower or seed heads, foliage, stems, crowns and roots all at the same time or during the plant's life cycle. Typically 15 to 20 years are needed to suppress or contain an established population of invasive plants. Agents approved by the Animal and Plant Health Inspection Service (APHIS) that are proven natural control agents of specific invasive species but do not harm other species may be released.
Cultural Methods/ Restoration	Cultural controls are defined in the R6 2005 FEIS as: "The establishment or maintenance of competitive vegetation, use of fertilizing, mulching, prescribed burning, or grazing animals to control or eliminate invasive plants" (page 10). In this project, the following cultural treatments are not included: livestock grazing[1], burning, tilling, plowing and mechanical seed drilling. Mulching, seeding, planting would be used to encourage native plant survival and re-establishment, speed reoccupation of a site by native vegetation, and provide erosion protection. Restoration of native plant communities through mulching, seeding or planting would be likely to occur as a follow up to invasive plant treatment in areas where passive restoration is not sufficient. This will be determined as a part of each treatment prescription. The 1,281 acres that are of a size and configuration to potentially warrant broadcast spraying are assumed to need some sort of restoration in this analysis. Please not that passive restoration could be sufficient in many of these areas, or restoration could be needed elsewhere.

Treatment Method	Description
Herbicide Application: General	Herbicides would be used to contain, control and eradicate invasive plants that are not cost-effectively treated by other methods. When herbicide use is proposed to occur in or near sensitive areas, specific design features would be used to insure that vegetation treatments do not have an adverse impact on non- target plants or animals. Herbicide treatments, chemical mixing, spill prevention, and clean up would be done in accordance with Forest Service policies, plans and product label requirements.
Herbicide Application: Broadcast Spraying	Broadcast application means that herbicide is applied to a continuous population of invasive plants. This method is used when the weed is dense enough that it is difficult to discern individual plants and the area to be treated makes spot spraying impractical. Larger and denser infestations may require a broadcast spray. In cases where the invasive plant covers more than 70 percent of an area that is bigger than 0.1 acre, broadcasting may be the most cost-efficient method. The most ambitious conceivable situation would be all currently infested areas become 100 percent covered with invasive plants, which would require the full amount of herbicide to be broadcast on each acre at a typical rate. Using this assumption for this analysis, about 1,281 acres are assumed to be broadcast in this analysis under alternative B. Many project design features are proposed to avoid drift and other risks sometimes associated with broadcast spraying. Broadcast spraying using most of the 11 herbicides is not allowed near streams (with the exception of aminopyralid which poses little to no risk to the aquatic environment).
Herbicide Application: Spot and Selective Spraying	Selective application targets individual plants. Herbicide is usually applied by hand. Spot spraying targets clumps of plants. Herbicide is usually applied with a backpack sprayer or other hand pump system. Spot spraying is also done using a hose off a truck-mounted or ATV-mounted tank. The most ambitious conceivable situation would be that all currently infested areas become 100 percent covered with invasive plants; however, the size of these infestations would not require broadcast treatment. Therefore under this scenario about 843 acres would be treated using selective or spot application methods.

[1] Grazing would be managed to prevent invasive plant introduction, establishment and spread and may reduce existing populations. These actions would be managed under appropriate grazing management plans. Prescribed burning would also address prevention of the spread of invasive plants and could reduce the size of target populations. However, no grazing or burning is proposed for this project.

The herbicide active ingredients listed in table 6 are likely to be most effective on the currently mapped infestations using the herbicide application methods described above. The assumption that currently infested areas are 100 percent covered with invasive plants, which would require even herbicide application across each acre, overestimates the amount of broadcast that would actually occur during implementation because many of the infested areas are sparsely covered with invasive plants, so only a portion of each acre would actually be treated with herbicide, regardless of application tool. However, the assumption of 100 percent coverage allows for analysis of maximum possible herbicide exposure and potential effects on people and the environment (see chapter 3 for effects analysis). Spot or hand treatments would be preferred and used wherever they would be effective. Some mapped infestations are so small or so inaccessible that broadcast treatment would not be likely to occur there, even if they became 100 percent covered with invasive plants.

Table 6. Summary of herbicide use under alternative B

First Year/First Choice Activity	Acres Assuming 100 Percent Coverage with Invasive Plants
Potential Broadcast Herbicide	
Aminopyralid	1,180
Chlorsulfuron	71
Metsulfuron methyl	30
Total Potential Broadcast Application Method	**1,281**
Potential Spot/Selective Herbicide	
Aminopyralid	168
Chlorsulfuron	519
Metsulfuron methyl	156
Total Potential Spot/Selective	**843**

The following table shows, for each herbicide, the active ingredient, the SERA risk assessment reference, the typical and maximum label rates, and some remarks about the herbicide. Maximum application rates may be used if necessary in small areas, but in general, spot and broadcast treatments will use typical or lower application rates. The SERA risk assessment reference and year is also given.

Adjuvants are compounds added to the formulation 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). Surfactants are one type of adjuvant that makes the herbicide more effective by increasing absorption into the plant. Many of the inert ingredients are proprietary in nature and have not been tested on laboratory species. However, confidential business information (i.e. the identity of proprietary ingredients) was considered in the preparation of the herbicide risk assessments completed prior to 2004.

Inert compounds are those that are intentionally added to a formulation, but have no herbicidal activity and do not affect the herbicidal activity. Inerts are added to the formulation to facilitate its handling, stability, or mixing. Impurities are inadvertent contaminants in the herbicide, usually present as a result of the manufacturing process. The risk assessments describe the impurities and their risks: in this project, hexachlorobenzene is a by-product of manufacturing picloram and clopyralid and is factored into the toxicity analysis for these chemicals.

The following table describes the herbicides authorized for use on the Forest. Most of these herbicides are not proposed for use during the first year of treatment, but could be used if the first year's choice is not effective or on newly detected infestations. More information on herbicide toxicity is in chapter 3.

Table 7. Herbicide descriptions

Active Ingredient	Risk Assessment Year and Reference	Typical Application Rate (lb. per ac)	Highest Application Rate (lb. per ac)	Remarks
Aminopyralid	2007 – SERA TR-052-04-04a	0.078	0.11	This herbicide poses a very low risk to the aquatic environments. We will avoid ground water contamination as per label instructions. Aquatic formulations are not available but we can use this herbicide up to the water's edge in most situations. It is the first-choice herbicide for about 64% of the currently infested acreage (about 1,346 acres).
Chlorsulfuron	2004 – SERA TR 04-43-18-01c	0.056	0.25	This herbicide poses a moderate risk to the aquatic environments and there are no aquatic formulations. We will not use this herbicide next to streams or on certain soils or near certain non-target plants as per project design features. It is the first-choice herbicide for about 28% of the currently infested acreage (about 591 acres).
Clopyralid	2004 – SERA TR 04 43-17-03c	0.35	0.5	This herbicide poses a low risk to aquatic environments. We will implement some soil restrictions due to its increased mobility in some soil types and we will avoid ground water contamination as per label instructions. It is one of the most target-species selective herbicides proposed for use.
Glyphosate	2011 – SERA_TR-052-22-03b	2	7	This is one of the most common herbicides used in Oregon and has the advantage of being effective on a very wide range of target species. Aquatic formulations are available; however some formulations of glyphosate have ingredients that may pose higher risk to aquatic environments. It is non-selective and quickly taken up by target plants. Many people have expressed concern about "round up" or "round up ready GMO crops" and its effect on human health. However, the studies that underpin the concerns are not applicable to the proposed project. The glyphosate risk assessment was updated recently and all current science was considered.
Imazapic	2004 – SERA TR 04-43-17-04b	0.13	0.19	This herbicide poses a moderate risk to aquatic environments and there is no aquatic formulation. This herbicide is associated with a concern for non-target plants and we will protect botanical species of conservation concern.
Imazapyr	2004 – SERA TR 04-43-17-05b	0.45	1.25	This herbicide poses a low risk to aquatic environments and an aquatic formulation is available. This herbicide is also associated with a concern for non-target plants and we will buffer botanical species of conservation concern.
Metsulfuron Methyl	2003 – SERA TR 04-43-17-01b	0.03	0.15	This herbicide poses a moderate risk to aquatic environments and no aquatic formulations are available. We will buffer streams when using this herbicide. This herbicide is also associated with a concern for non-target plants and we will protect botanical species of conservation concern. It is the first-choice herbicide for about 8% of the currently infested acreage (about 186 acres).

Active Ingredient	Risk Assessment Year and Reference	Typical Application Rate (lb. per ac)	Highest Application Rate (lb. per ac)	Remarks
Picloram	2003 – SERA TR 03-43-16-01b	0.35	1.0	This herbicide poses higher risk to aquatic environments and there is no aquatic label. We will not use this herbicide near streams, especially because it is toxic to certain aquatic species and it can be very mobile. It is valued for its persistence in the soil; we will not use it on certain soils and we will use it infrequently to protect soil biology.
Sethoxydim	2001 – SERA TR 01-43-01-01c	0.3	0.38	This herbicide poses a moderate risk to aquatic environments and there is no aquatic label. We will not use it near streams. It is very selective (only kills grasses).
Sulfometuron Methyl	2004 – SERA TR 03-43-17-02c	0.045	0.38	This herbicide poses a moderate risk to aquatic environments and no aquatic formulations are available. We will buffer streams when using this herbicide. This herbicide is also associated with a concern for non-target plants and we will protect botanical species of conservation concern.
Triclopyr	2003 – SERA TR 02-43-13-03b	1.0	10	This herbicide poses higher risk to aquatic environments, however there is an aquatic label that reduces (but does not eliminate) the risk. We will not use this herbicide near streams. This herbicide poses some risk to herbicide applicators and will not be broadcast as per R6 2005 ROD Standard 16. It may only be spot or selectively applied and only in limited cases.

Integrated Treatment Prescriptions (Common Control Measures) For 18 Primary Target Species

The following table lists the 18 primary target species; common and scientific names, (scientific code), and growth habit; spatial extent (no. of sites and acres); first-choice and other herbicides known to be effective on each species (or group of species) and detailed integrated prescription notes. The order species are presented is for the convenience of display and no other meaning should be ascribed. The order of other effective herbicides is alphabetical and no other meaning should be ascribed.

We propose to apply aminopyralid to about 64 percent of the infested acreage for the first treatment entry (about 1,350 acres) and chlorsulfuron for the first treatment entry on 28 percent of the acres (about 591 acres), and metsulfuron methyl for one target species: sulphur cinquefoil that covers an estimated 8 percent of the acres (about 186 acres). We may use other effective herbicides in future re-treatments depending on the effectiveness of the first-choice herbicide.

Table 8. Common control measures

Primary Target Species	First-Choice Herbicide	Other Effective Herbicides	Integrated Treatment Notes
Yellow star-thistle *Centaurea solstitialis* (CESO3) Annual	aminopyralid	clopyralid glyphosate picloram	Early detection and treatment increase the chances of control. Treatment of small infestations in otherwise healthy sites should be a priority Biological control agents are available. Hand pull when soil is moist and remove all roots and flower and seed heads.
Common St. Johnswort *Hypericum perforatum* (HYPE) Perennial with stolons and rhizomes	aminopyralid	glyphosate metsulfuron methyl picloram	Biological agents are available. Small infestations may be controlled by pulling or digging. Repeated treatments will be necessary because lateral roots can give rise to new plants. Bag and remove all plant parts from site.
Sulphur cinquefoil *Potentilla recta* (PORE5) Taprooted perennial that may have several shallow, spreading branch roots but not rhizomes	metsulfuron methyl	glyphosate picloram triclopyr	Cultural treatments such as seeding of native plants may be effective. There are no approved biocontrols. Small infestations may be controlled by hand digging if the entire root crown is removed. For large infestations, selective herbicides are likely the only method of effective control (TNC 2004). Repeated treatments are needed for the first couple of years to ensure re-establishment does not occur.
Russian knapweed *Acroptilon repens* (ACRE3)	aminopyralid	clopyralid chlorsulfuron glyphosate imazapyr metsulfuron methyl picloram	Hand pulling is effective only in the establishment year. Reproduces mainly by vegetative propagation from buds on creeping roots. Biocontrol agents being developed. Cutting or mowing several times per year will control top growth and seed production; re-

Primary Target Species	First-Choice Herbicide	Other Effective Herbicides	Integrated Treatment Notes
Long-lived creeping perennial			emerging plants will have less vigor. Lasting control requires an integrated approach; using mechanical or cultural measures with herbicide application, especially in late fall, is most effective. Small, isolated infestations should be eradicated first. Then larger infestations should be controlled from the perimeter and eradicated when possible.
Spotted knapweed *Centaurea stoebe ssp. Micranthos* (CESTM) Taprooted perennial	aminopyralid	clopyralid glyphosate triclopyr picloram	Treatment would focus on reducing seed production and preventing germination. Biological agents are available. Repeated manual pulling and digging may eliminate small infestations (2-4 times per year for multiple years). Pull prior to seed set. Bag and remove flower and seed heads.
Diffuse knapweed *Centaurea diffusa* (CEDI) Short-lived perennial, biennial or annual. Often with a long, stout taproot	aminopyralid	clopyralid glyphosate picloram triclopyr	
Squarrose knapweed *Centaurea ulfome ssp. Squarrosa* (CEVIS2) Taprooted perennial	aminopyralid	clopyralid glyphosate picloram triclopyr	
Meadow knapweed *Centaurea jacea sensulato* (CEJA) Taprooted perennial	aminopyralid	clopyralid glyphosate picloram triclopyr	

Primary Target Species	First-Choice Herbicide	Other Effective Herbicides	Integrated Treatment Notes
Canada thistle *Cirsium arvense* (CIAR4) Rhizomatous perennial	aminopyralid	clopyralid chlorsulfuron picloram	Combining mechanical, cultural, biological, and chemical methods is best for effective control Biological agents are available, but use may affect native thistles. Mowing, cutting or pulling can be an effective control if repeated at about 1-month intervals throughout the growing season for several years. Combining mowing/cutting with herbicides (in the fall) will further enhance control of Canada thistle. Covering with plastic tarp (solarization) may be effective for small infestations.
Bull thistle* *Cirsium vulgare* (CIVU) Taprooted biennial	aminopyralid	clopyralid chlorsulfuron glyphosate picloram triclopyr	Prioritize small infestations in otherwise healthy sites. Prioritize prevention of establishment and eliminating plants as soon as they are found. Biological agents are available, but use may affect native thistles Manually pulling rosettes or cutting stems 2”-4” below the soil surface before flower heads develop kills plants and prevents seed development. Roots may be left on site to dry; all flower and seed heads should be removed. Covering disturbed sites, particularly small burn areas, with fine to medium sized organic matter may prevent or reduce the size of infestations.
Scotch Thistle *Onopordum acanthium* (ONAC) Taprooted biennial or short-lived perennial	aminopyralid	chlorsulfuron clopyralid glyphosate picloram triclopyr	
Musk thistle *Carduus nutans* (CANU4) Taprooted biennial or occasional annual	aminopyralid	chlorsulfuron clopyralid glyphosate picloram triclopyr	
Leafy spurge *Euphorbia esula* (EUES) Rhizomatous perennial	aminopyralid	glyphosate imazapic picloram	Early detection and rapid eradication is important since plant spreads rapidly by seeds and rhizomes. Continuous aggressive management is necessary to keep infestations under control (5 – 10 years). Prioritizing treatment of small infestations, then treating large infestations from the

Primary Target Species	First-Choice Herbicide	Other Effective Herbicides	Integrated Treatment Notes
			outside edges is most effective. Biological control agents may reduce aboveground stems but do not kill root systems. Mechanical, cultural, or herbicide methods alone are rarely effective. Combinations of several herbicide treatments and planting grass seed may provide the best chance of controlling the species. Hand pulling and grubbing are not effective because of the extensive root system. Cutting and mowing reduce seed production and the plant's competitive ability. Covering with weed cloth, plastic, or thick mulch may kill plants. Site can then be planted with native seed. If manual methods are used all plant parts should be bagged and removed since new plants may form from roots and rhizomes as well as from seeds. Plant's milky sap may be irritating to skin, eyes, and digestive tract of humans and other animals.
Houndstongue *Cynoglossum officinale* (CYOF) Taprooted biennial or short-lived perennial	chlorsulfuron	metsulfuron methyl imazapic	Mowing/cutting second year plants during flowering, but before seed maturation reduces seed production and may kill the plant. Pulling plants or cutting 1 – 2 inches below the soil surface have the best chance of eliminating plants. Cutting produces less ground disturbance than pulling. Bag and remove all flower and seed heads.
Dalmatian toadflax *Linaria dalmatica* (LIDA) Perennial with taproot and extensive system of lateral roots	chlorsulfuron	metsulfuron methyl imazapic picloram	Dalmatian toadflax reproduces primarily by seed and partly by adventitious root buds. Yellow toadflax reproduces primarily by adventitious root buds on lateral roots. Biological agents are available and may be very effective. Manual pulling and digging may not be effective because of the deep (4-10 feet) and laterally extensive root systems (to 10 feet from plant). If manually removed, all roots and flower and seed heads should be bagged and removed.
Yellow toadflax *Linaria vulgare* (LIVU2) Perennial with taproot and	chlorsulfuron	metsulfuron methyl imazapic picloram	

Primary Target Species	First-Choice Herbicide	Other Effective Herbicides	Integrated Treatment Notes
extensive system of vertical and creeping lateral roots			Cutting stems in spring or early summer would eliminate seed production, but not the root system. If biocontrol agents continue to be effective, herbicide application may not be needed.
Whitetop *Cardaria draba* (CADR) Rhizomatous perennial	chlorsulfuron	metsulfuron methyl glyphosate imazapic imazapyr	These species are difficult to control because of its deep taproots (9 ft.) and ability to sprout from root fragments. Early detection and proactive management is most effective since established infestations are difficult to control.
Perennial pepperweed *Lepidium latifolium* (LELA2) Perennial with rhizome like creeping roots			Frequent monitoring for new sites and prioritizing small infestations in otherwise healthy sites is important.. Next priority would be for corridors such as waterways and irrigations structures that have a high likelihood of spread. Biological controls are not available. Repeated pulling may control small, young infestations. Established plants are likely to resprout from deep roots. All roots and flower and seed heads should be removed. Mowing does not eliminate plants but removes thatch.

*Bull thistle and Canada thistle were cataloged together in our November 2012 invasive plant inventory. However, the precise species would be identified before an integrated treatment prescription would be applied.

Project Design Features

The following project design features (pdfs) minimize the potential impacts of invasive plant treatment. These pdfs provide sideboards for treatment of known sites, along with new detections. The pdfs were developed to respond to the site-specific resource conditions within the infested areas, including (but not limited to) botanical areas; habitat and presence of botanical, wildlife and/or fish species of conservation concern; the potential for herbicide delivery to water, and proximity other areas of interest (roads and trails, recreation sites, Wilderness/Wild and Scenic Rivers, wildland fire areas). Implementation of the pdfs would be mandatory. The analysis assumes pdfs are properly implemented. The herbicide-use buffers apply horizontal (map) distances. The pdfs and herbicide-use buffers follow national Best Management Practice guidelines for chemical uses on national forests (USDA Forest Service2012). The project design features associated with alternative B are summarized in the following table.

Table 9. Project Design Features

pdf Reference	Design Features	Purpose of pdf	Source of pdf
B – Coordination with Other Landowners/Agencies			
B1	Work with owners and managers of neighboring lands to respond to invasive plants that straddle multiple ownerships.	To ensure that neighbors are fully informed about nearby herbicide use and to	A variable distance based on site and species specific

pdf Reference	Design Features	Purpose of pdf	Source of pdf
	Coordinate treatments within appropriate distances based on invasive species reproductive characteristics, and current use of area.	increase the effectiveness of treatments on multiple ownerships.	characteristics was chosen because it adjusts for various conditions that exist in these areas. All pdfs related to riparian areas and buffer distances will be followed.
C – To Prevent the Spread of Invasive Plants During Treatment Activities			
C1	Ensure vehicles and equipment (including personal protective clothing) does not transport invasive plant materials.	To prevent the spread of invasive plants during treatment activities	Common measure.
D – Wilderness Areas [10]			
D1	No solarization, mechanical or motorized treatments will occur in wilderness areas. Herbicide use would be approved by the Regional Forester via a pesticide use proposal.	To maintain wilderness values, e.g., solitude, unimpeded natural processes—and comply with environmental laws and policies.	Wilderness Act, 1990 Malheur National Forest Plan
E – Non-herbicide Treatment Methods			
E1	Treatments implemented below the ordinary high water mark will be applied from the bank and workers will not walk in flowing streams regardless of treatment method.	To reduce the likelihood of causing negative impacts to fish and fish habitat.	Memorandum of Understanding between WDFW and USDA Forest Service, January 2005.
E2	Fueling of gas-powered equipment with tanks larger than 5 gallons would generally not occur within 150 feet of surface waters. Fueling of gas-powered machines with tanks smaller than 5 gallons may occur up to 25 feet of surface waters.	To protect riparian and aquatic habitats.	Common Measure
F – Herbicide Applications			
F1	POEA surfactants, urea ammonium nitrate or ammonium sulfate would not be used in applications within 100 feet of surface water, wetlands or on roadside treatment areas having high potential to deliver herbicide.	To protect aquatic organisms.	SERA and Bakke risk assessments
F2	The least amount of a given herbicide would be applied as necessary to meet control objectives. NPE surfactant would not be broadcast at a rate greater than 0.5 lbs. a.i./ac (pounds of active ingredient per acre). Favor other classes of surfactants wherever they are expected to be effective. In no case will imazapyr use exceed 0.70	To eliminate possible herbicide or surfactant exposures of concern to human health.	SERA and Bakke risk assessments

[10] Invasive plant eradication within Wilderness meets the "no impact" intent of the Wilderness Act and associated land use policies.

pdf Reference	Design Features	Purpose of pdf	Source of pdf
	lbs. a.i./ac. Broadcast application of Clopyralid, Glyphosate, Picloram, Sethoxydim, or Sulfometuron methyl will not exceed typical application rates.		
F3	Broadcast herbicide applications would occur when wind velocity is between two and eight miles per hour to reduce the chance of drift. During application, weather conditions would be monitored periodically by trained personnel.	To ensure proper application of herbicide and reduce drift.	These restrictions are typical so that herbicide use is avoided during inversions or windy conditions.
F4	To minimize herbicide application drift during broadcast operations, use low nozzle pressure; apply as a coarse spray, and use nozzles that minimize fine droplet spray, e.g., nozzle diameter to produce a median droplet diameter of 500-800 microns.	To ensure proper application of herbicide and reduce drift.	These are typical measures to reduce drift. The minimum droplet size of 500 microns was selected because this size is modeled to eliminate adverse effects to non-target vegetation 100 feet or further from broadcast sites (see chapter 3 for details).
F5	No use of sulfonylurea herbicides (chlorsulfuron, sulfometuron methyl and metsulfuron methyl) on dust-laden bare soils. Avoid bare areas >100 sq. ft. with powdery, ashy dry soil, or light sandy soil.	To avoid potential for herbicide drift.	Label advisory
F6	When herbicides are applied, a non-toxic blue dye will be used to mark treated areas.	To ensure treated areas are obvious to people and prevent accidental ingestion by plant collectors.	Common measure
G Herbicide Transportation and Handling Safety/Spill Prevention and Containment § An *Herbicide Transportation and Handling Safety/Spill Response Plan* would be the responsibility of the herbicide applicator. At a minimum the plan would: § Address spill prevention and containment. § Estimate and limit the daily quantity of herbicides to be transported to treatment sites. § Require that impervious material be placed beneath mixing areas in such a manner as to contain small spills associated with mixing/refilling. § Require a spill cleanup kit be readily available for herbicide transportation, storage and application (minimum FOSS Spill Tote Universal or equivalent). § Outline reporting procedures, including reporting spills to the appropriate regulatory agency. § Ensure applicators are trained in safe handling and transportation procedures and spill cleanup. § Require that equipment used in herbicide storage, transportation and handling are maintained in a leak proof condition. § Address transportation routes so that traffic, domestic water sources, and blind curves are avoided to the extent possible. § Specify conditions under which guide vehicles would		To reduce likelihood of spills and contain any spills.	FSH 2109.14

pdf Reference	Design Features	Purpose of pdf	Source of pdf
	be required. § Specify mixing and loading locations away from water bodies so that accidental spills do not contaminate surface waters. § Require that spray tanks be mixed or washed further than 150 feet of surface water. § Ensure safe disposal of herbicide containers. § Identify sites that may only be reached by water travel and limit the amount of herbicide that may be transported by watercraft.		
H - Soils, Water and Aquatic Ecosystems			
H1	Follow herbicide-use buffers shown below. Tank mixtures would apply the largest buffer as indicated for any of the herbicides in the mixture.	To reduce likelihood that herbicides would enter surface waters in concentrations of concern and ensure that the project does not hamper attainment of riparian management objectives.	Herbicide-use buffers are based on label advisories; SERA risk assessments and Berg's 2004 study of broadcast drift and run off to streams. Herbicide-use buffers are intended to demonstrate compliance with R6 2005 ROD Standards 19 and 20.
H2	In riparian and aquatic settings, vehicles (including all-terrain vehicles) used to access invasive plant sites, or for broadcast spraying will not travel off roadways, trails and parking areas if damage to riparian vegetation, soil and water quality, and aquatic habitat is likely.	To protect riparian and aquatic habitats.	Common protection measure
H3	Avoid using picloram and/or metsulfuron methyl on bare or compact soils, and inherently poor productivity soils that are highly disturbed. Poor soils include shallow soils less than 20 inch depth that lack topsoil and serpentine soils.	To preserve site recovery after disturbance, lessen offsite runoff and leaching. Poor soils will have longer residence times with these persistent herbicides.	Label advisory
H4	Do not use more than one application of picloram or metsulfuron methyl on a given area in a calendar year, except to treat areas missed during the initial application.	Reduce potential for accumulation in soil.	SERA Risk Assessments. Based on quantitative estimate of risk from a maximum level of exposure.
H5	Limit herbicide offsite transport on sites with high runoff potential including sites with: shallow seasonal water tables, saturated soils (wet muck and peat soils), steep erosive slopes with shallow soils and rock outcrop, or bare compacted and disturbed soils. Limit runoff by applying herbicide during the dry season with the lowest soil moisture conditions, where > 50% groundcover exists on shallow slope sites, and > 70% on steep slope sites, and/or at reduced rates.	Reduce potential offsite runoff transport of herbicides.	SERA Risk Assessments and Label. Based on quantitative risk for erosion and runoff.
H6	For soils with seasonally high water tables, do not use picloram or triclopyr	Reduce the risk for contamination of	Label advisory

pdf Reference	Design Features	Purpose of pdf	Source of pdf
	BEE and limit glyphosate use to aquatic label only.	groundwater and offsite runoff to aquatic habitat and fish.	
H7	Lakes and Ponds – No more than half the perimeter or 50 percent of the vegetative cover within established buffers or 10 contiguous acres around a lake or pond would be treated with herbicides in any 30-day period. This limits area treated within riparian areas to keep refugia habitat for reptiles and amphibians.	To reduce exposure to herbicides by providing some untreated areas for organisms to use.	SERA Risk Assessments. Based on quantitative estimate of risk from maximum herbicide exposure scenario and uncertainty regarding effects to reptiles and amphibians.
H8	Wetlands would be treated when soils are driest. If herbicide treatment is necessary when soils are wet, use aquatic labeled herbicides. Favor hand/selective treatment methods where effective and practical. No more than 10 contiguous acres or fifty percent individual wetland areas would be treated in any 30-day period.	To reduce exposure to herbicides by providing some untreated areas for some organisms to use.	SERA Risk Assessments. Based on quantitative estimate of risk from maximum herbicide exposure scenario and uncertainty in effects to some organisms, and label advisories.
H9	Herbicide use would not occur within 100 feet of wells or 200 feet of spring developments. For stock tanks located outside of riparian areas, use wicking, wiping or spot treatments within 100 feet of the watering source.	To reduce the potential for herbicide delivery to wells and springs that provide drinking water, and to protect watering systems used for grazing animals.	Label advisories and state drinking water regulations.
H10	Use of Triclopyr BEE is not allowed except in dry upland areas that are not hydrologically connected to streams or ponds with water present.	Reduce the risk for contamination of groundwater and offsite runoff to aquatic habitat and fish.	Label and quantitative assessment for risk to aquatic organisms.
H11	Do not spray when local weather forecast calls for a ≥ 50% chance of rain, or when wind speed at the site is in excess of 8 mph.	Reduce potential offsite runoff transport of herbicides.	SERA Risk Assessments and Label. Based on quantitative risk for erosion and runoff.
I - Vascular and Non-Vascular Plant and Fungi Species of Concern			
I1	A USDA Forest Service botanist would use monitoring results/adaptive management to refine herbicide-use buffers in order to adequately protect botanical species on the Regional Forester's Sensitive List.	To prevent any repeated effects to sensitive botanical populations, thereby mitigating any long-term effects. Uncertainty about effects on nonvascular plants would be addressed through monitoring.	Herbicide-use buffer sizes for broadcast of most herbicides are based on Marrs 1989 based on tests on vascular plants. Spot and hand/select buffer distances are based on reports from experienced applicators.
I2	Botanical surveys will be conducted to document locations of sensitive plants if suitable habitat is within 100 feet of planned herbicide treatments	To ensure sensitive botanical species are protected and botanical surveys are conducted when appropriate	Forest Service Manual 2670 and applicable federally listed recovery plans
I3	Sensitive plants located within 100 feet of planned ground-based broadcast applications would be covered by protective barrier, or broadcast	To ensure sensitive botanical species are protected	Forest Service Manual 2670 and applicable federally listed recovery

pdf Reference	Design Features	Purpose of pdf	Source of pdf
	application would be avoided in these areas (spot or hand herbicide treatment, or non-herbicide methods may be used without covering sensitive plants)		plans
I4	When sensitive plants are within 10 feet of saturated or wet soils at the time of herbicide application, only hand methods (wiping, stem injection,) would be used. Avoid the use of picloram and imazapyr in this situation, and use aquatic triclopyr with caution as typical application rates can result in concentrations greater than estimated or measured “no observable effect concentration” to aquatic plants (R6 2005 FEIS, Table 4-47).	To ensure sensitive botanical species are protected	Forest Service Manual 2670 and applicable federally listed recovery plans
I6	Monitoring prework review would occur before implementation to ensure that prescriptions, contracts and agreements integrate appropriate project design features.	To ensure sensitive botanical species are protected	Forest Service Manual 2670 and applicable federally listed recovery plans
I7	Implementation monitoring would occur during implementation to ensure project design features are implemented as planned. An implementation monitoring form will be used to document daily field conditions, activities, accomplishments and/or difficulties. Contract administration mechanisms would be used to correct deficiencies. Herbicide use will be reported as required by the Forest Service Health Pesticide Use Handbook.	To ensure sensitive botanical species are protected	Forest Service Manual 2670 and applicable federally listed recovery plans
I8	Effectiveness monitoring would occur during and after treatment to determine whether invasive plants are being effectively controlled and to ensure non-target vegetation, especially sensitive species are adequately protected.	To ensure sensitive botanical species are protected	Forest Service Manual 2670 and applicable federally listed recovery plans
I9	The impacts of herbicide use on some sensitive botanical species are uncertain, especially non-vascular species. To manage this uncertainty, representative samples of herbicide treatment sites adjacent to sensitive botanical species would be monitored. Non-target vegetation within 100 feet of herbicide broadcast treatment sites and 20 feet of herbicide spot and hand treatment sites would be evaluated before treatment, immediately after treatment, and two to three months later as appropriate. Herbicide-use buffers would be expanded if damage is found as indicated by: •Decrease in the population of the species of conservation concern •Leaf discoloration or chlorophyll change	To ensure SOLI are protected and survey are conducted when appropriate	Forest Service Manual 2670 and applicable federally listed recovery plans

pdf Reference	Design Features	Purpose of pdf	Source of pdf
	•Mortality Monitoring would continue until three post-treatment visits (at one or more sites near each sensitive botanical species) confirm a lack of adverse effects.		
J - Wildlife Species of Local Interest			
J1	**Gray Wolf**		
J1-a	Treatments within 1 mile of active wolf dens or rendezvous sites would only occur outside the season of occupancy (April 1 through June 30).	Reduce impacts to active dens or rendezvous sites	Federal Register (USDI FWS 2003)
J2	**Bald eagle**		
J2-a	Noise-producing activity above ambient levels would not occur near known winter roosts and concentrated foraging areas between October 31 and March 31 during the early morning or late afternoon. Disturbance to daytime winter foraging areas would be avoided.	Minimize disturbance and energy demands during the winter.	Bald Eagle Management Guidelines for OR-WA (Dillon 1981); USDI FWS 2007, No, 62 4(d)
J2-b	Treatment of areas within 0.25 mile, or 0.50 mile line-of-sight, of bald eagle nests would be timed to occur outside the nesting/fledging season of January 1 to August 31, unless treatment activity is within ambient levels of noise and human presence (as determined by a local specialist). Occupancy of nest sites (i.e. whether it is active or not) would be determined each year prior to treatments.	Reduce impacts to eagle nests and reproduction.	Bald Eagle Management Guidelines for OR-WA (Dillon 1981) and, USDA Forest Service 2005a
J3	**Peregrine Falcon**		
J3-a	Seasonal restrictions shall apply to all known peregrine falcon nest sites for the periods and elevations listed below: a. Low elevation sites (1000-2000 ft.) – Jan 1st to July 1st b. Medium elevation sites (2001-4000 ft.) – Jan 15th to July 31st c. Upper elevation sites (greater than 4000 ft.) – Feb 1st to Aug 15th These restrictions may be waived if the site is unoccupied or if nesting efforts fail and monitoring indicates no further nesting behavior. Seasonal restrictions shall be extended if monitoring indicates late season nesting, asynchronous hatching leading to late fledging, or recycle behavior which indicates that late nesting and fledging will occur. Protection would be provided until at least two weeks after all young have fledged.	Reduce disturbance to nesting birds and protect eggs and nestlings.	Pagel 2006 Peregrine falcon nest site data, 1983-2006.
J3-b	All invasive plant treatments would be restricted within 0.5 miles of peregrine	Reduce disturbance to	Pagel 2006

pdf Reference	Design Features	Purpose of pdf	Source of pdf
	falcon nests (primary nest zone) during the nesting season (described above).	nesting birds and young.	Peregrine falcon nest site data, 1983-2006.
J3-c	Invasive plant treatments involving motorized equipment and/or vehicles would be seasonally prohibited within the secondary nest zone (0.5 miles to 1.5 miles of known nest sites) during the nesting season. This may include activities such as mulching, chainsaws, vehicles (with or without boom spray equipment) or other mechanically-based invasive plant treatment.	Reduce disturbance to nesting birds and young.	Pagel 2006 Peregrine falcon nest site data, 1983-2006.
J3-d	Non-mechanized or low disturbance invasive plant activities (such as spot spray, hand pull, etc.) may occur within the secondary nest zone (0.5 miles to 1.5 miles of known nests) during the nesting season, but would be coordinated with the wildlife biologist on a case-by-case basis to determine potential disturbance to nesting falcons and identify mitigating measures, if necessary.	Reduce disturbance to nesting birds and young.	Pagel 2006 Peregrine falcon nest site data, 1983-2006.
J3-e	Picloram and Clopyralid would not be used within 1.5 miles of a peregrine nest more than once per year.	Reduce herbicide exposure to eggs.	Pagel 2006 Peregrine falcon nest site data, 1983-2006.
J4	**Greater Sage Grouse**		
J4-a	Do not use NPE-based surfactants in areas where sage grouse may forage, as determined by the district wildlife biologist. Glyphosate would be limited to the typical application rate.	Minimize exposure to herbicides and surfactants that could pose a risk.	Biological Evaluation for Malheur Invasive Plant EIS, USDA Forest Service 2000.
J4-b	Human activities within 0.3 mile of leks will be prohibited from the period of one hour before sunrise until four hours after sunrise and one hour before sunset until one hour after sunset from February 15 – May 15.	Minimize disturbance to breeding grouse	Connelly et al. 2000, USDI FWS 2003.
J4-c	Do not conduct any vegetation treatments or improvement projects in breeding habitats from February 15 – June 30.	Minimize disturbance to breeding grouse	Connelly et al 2000
J5	**Columbia Spotted Frog**		
J5-a	Avoid broadcast spraying of herbicides, and spot spraying of glyphosate with POEA surfactant, sulfometuron methyl, and NPE-based surfactants within 100 feet of occupied or suitable spotted frog habitat. Follow herbicide-use buffers in wetlands. Treatment methods, timing and location will be coordinated with a local biologist prior to implementation.	Reduce impacts to the Columbia spotted frog.	Appendix P of the R6 2005 FEIS; SERA 2003, 2004; Bakke 2003
J6	**Silver bordered fritillary**		
J6-a	Within occupied sites, follow pdfs identified under vascular plants of concern to protect host/nectar plant	Reduce the likelihood host/nectar plants would be affected.	Malheur Invasive Plant BE.

pdf Reference	Design Features	Purpose of pdf	Source of pdf
	species.		
J6-b	Within occupied habitat proposed for treatment, use of ester formulations of herbicide and NPE-based surfactants would be prohibited.	Minimize exposure of herbicides and surfactants that could pose a risk to the silver bordered fritillary.	Malheur Invasive Plant BE.
J7	**Pygmy Rabbit**		
J7-a	Within suspected burrow areas, activities will be restricted to manual techniques. Treatment methods, timing and location will be coordinated with a local biologist.	Minimize chances a burrow would collapse.	Malheur Invasive Plant BE.
J8	**Upland Sandpiper**		
J8-a	In order to avoid disturbance or potential trampling of nesting upland sandpipers, no treatment would occur on sites that have historic or recent documentation of upland sandpipers during the nesting season (April 1st to August 1st), unless the site has been surveyed and no nesting is occurring.	Minimize likelihood that nests would be disturbed during treatment.	Malheur Invasive Plant BE.
J9	**Grasshopper Sparrow**		
J9-a	In order to avoid disturbance or potential trampling of nesting birds during the nesting season (May 1st to August 1st), no treatment would occur on sites where grasshopper sparrows have been documented.	Minimize likelihood that nests would be disturbed during treatment.	Malheur Invasive Plant BE.
J10	**Harney Basin Duskysnail**		
J10-a	If an occupied site is proposed for treatment, a local biologist would be consulted to determine protection measures, if necessary. These measures may include limitations on vehicle entry, modifications to treatment type or timing, or implementation of buffers.	Minimize likelihood that snails would be harmed from treatment	Malheur Invasive Plant BE
J11	**Featured Species: Raptors and Osprey**		
J11-a	Active raptor nest sites will be protected during implementation. If a raptor nest is found within 0.50 mile of a site proposed for treatment, a wildlife biologist will be consulted to determine appropriate seasonal restriction dates and buffer distances, if necessary.	Reduce impacts to raptor nesting and reproduction.	Malheur Forest Plan Ochoco Forest Plan
J12	**Big game**		
J12-a	Restrict off-highway vehicle use within MA 41 (big game winter range) between December 1 and April 1.	Reduce disturbance to wintering elk and deer.	Malheur Forest Plan
J12-b	To prevent harassment in designated calving areas, restrict off-highway vehicles and other motorized traffic use to designated roads and trails from May 1 to June 31.	Reduce impacts during elk calving.	Malheur Forest Plan

pdf Reference	Design Features	Purpose of pdf	Source of pdf
K	**Public Notification**		
K1	High use areas, including administrative sites, developed campgrounds, visitor centers, and trailheads would be posted in advance of herbicide application or closed. Postings would indicate the date of treatments, the herbicide used, and when the areas are expected to be clear of herbicide residue. See also L2 for special products and M1 for cultural plants.	To ensure that no inadvertent public contact with herbicide occurs.	These are common measures to reduce conflicts.
K2	The public would be notified about upcoming herbicide treatments via the local newspaper or individual notification, fliers, and posting signs. Forest Service and other websites may also be used for public notification.	To ensure applicators know what area has been treated and to ensure no inadvertent public contact with herbicide occurs.	R6 2005 ROD Standard 23 (see table 1).
L	**Special Forest Products**		
L2	Special forest product gathering areas may be closed for a period of time to ensure that no inadvertent public contact with herbicide occurs.	To eliminate any scenario where people might be exposed to herbicide.	R6 2005 ROD Standard 23
L3	Popular berry and mushroom picking areas would be posted prominently, marked on the ground or otherwise posted.	To eliminate any scenario where people might be exposed to herbicide.	R6 2005 ROD Standard 23
L4	Special forest product gatherers would be notified about herbicide treatment areas when applying for their permits. Flyers indicating treatment areas and explaining the use of blue dye may be included with the permits, in multi-lingual formats if necessary. See section K.	To ensure that no inadvertent public contact with herbicide occurs.	R6 2005 ROD Standard 23
M	**American Indian Tribal and Treaty Rights and Archaeology**		
M1	American Indian tribes would be notified annually as treatments are scheduled so that tribal members may provide input and/or be notified prior to gathering cultural plants. Cultural plants identified by tribes would be buffered as above for botanical species of concern; see section I2, I3, and I4).	To ensure that no inadvertent public contact with herbicide occurs and that cultural plants are fully protected.	Government to government agreements between American Indian tribes and the Malheur National Forest.
N	**Range Resources**		
N2	Permittees will be notified of annual treatment actions at the annual permittee operating plan meeting, and/or notified within 2 weeks of planned treatments of infestations > 1 acre in size.	To ensure permittee has knowledge of activities occurring within the allotment	Common Practice
N3	Follow most current EPA herbicide label for grazing restrictions.	To ensure grazing animals are not exposed to chemicals	EPA labeling requirements

Herbicide-use buffers

Herbicide treatments would become more restrictive as they occur close to water. Project design features and herbicide-use buffers within the aquatic influence zone were developed based on label advisories, SERA risk assessments, and various studies of drift and runoff to streams such as Berg 2004. Figure 3 shows the water's edge and bankfull (i.e., high water mark). The further away from these areas, the greater the number of options available.

In general, aquatic labeled herbicides and aminopyralid may be used to the water's edge, with potential additional restrictions, depending on soils or other factors such as herbicide effectiveness on the target species and sensitivity and susceptibility of non-target species.

The assumption under this project is that if any part of an infested area falls within an herbicide use buffer, the buffer restrictions apply to the entire infestation. This assumption is reasonable because of the nature of herbicide application; fine distinctions are often difficult to discern on the ground and applicators would likely use one tankful to do an entire job rather than switching between tanks during treatment.

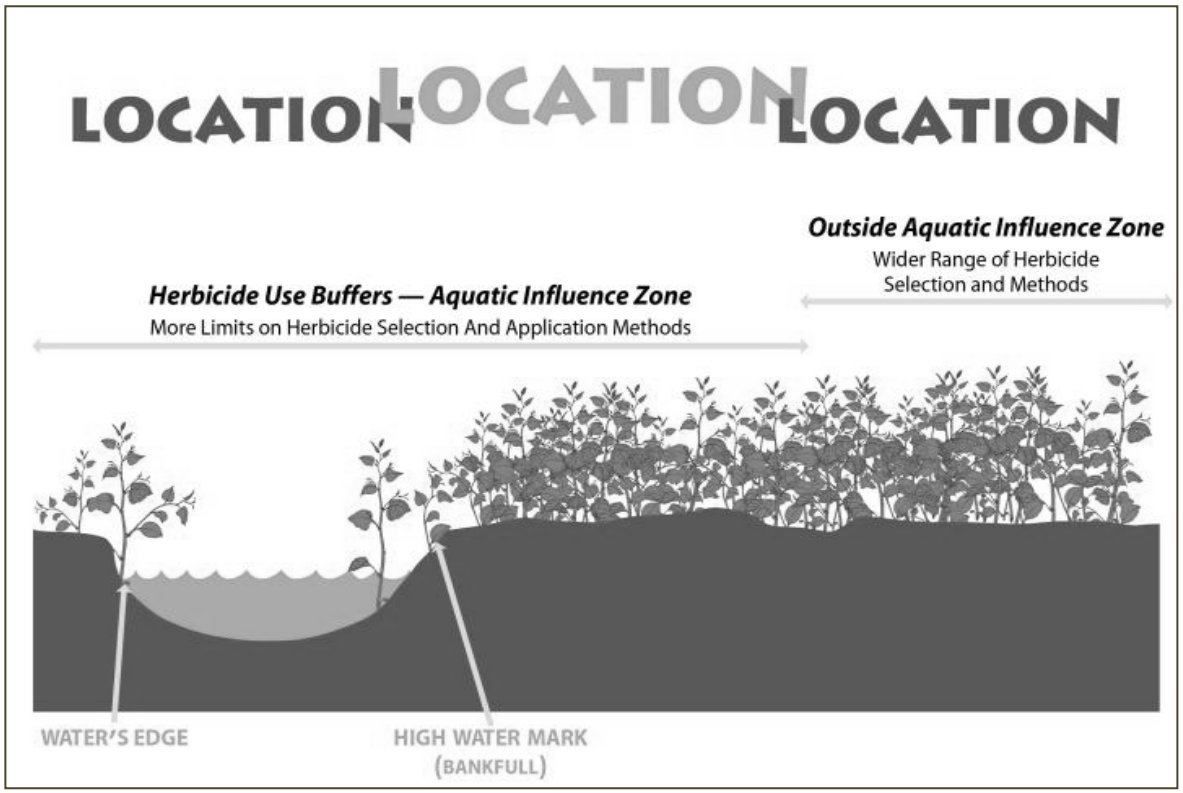

Figure 3. Herbicide-use buffers

Table 10. Herbicide-use buffers (in feet) for streams, wetlands, lakes and ponds with water present at the time of treatment. Measured in feet from the edge of surface water.

Herbicide	Streams, wetlands, lakes and ponds with surface water	
	Broadcast	**Spot/Hand/Select**
Aquatic Glyphosate	50	Water's edge
Aquatic Imazapyr	50	Water's edge
Aquatic Triclopyr-TEA	Not Allowed	15
Aminopyralid	**Water's edge**	**Water's edge**
Clopyralid	100	15
Imazapic	100	15
Metsulfuron Methyl	**100**	**15**
Imazapyr	100	50
Sulfometuron Methyl	100	50
Chlorsulfuron	**100**	**50**
Picloram	100	50
Sethoxydim	100	50
Glyphosate	100	50

Table 11. Herbicide-use buffers (in feet) for stream channels that are dry at the time of treatment. Measured in feet from the edge of the channel as defined by the high water (bankfull) mark

Herbicide	Intermittent and Ephemeral Streams (Dry at time of treatment)	
	Broadcast	**Spot/Hand/Select**
Aquatic Glyphosate	Bankfull	No buffer
Aquatic Imazapyr	Bankfull	No buffer
Aquatic Triclopyr-TEA	Not Allowed	Bankfull
Aminopyralid	**No Buffer**	**No Buffer**
Imazapic	50	Bankfull
Metsulfuron Methyl	**50**	**Bankfull**
Clopyralid	50	Bankfull
Imazapyr	50	15
Sulfometuron Methyl	50	15
Chlorsulfuron	**50**	**15**
Picloram	100	50
Sethoxydim	100	50
Glyphosate	100	50
Triclopyr-BEE	Not Allowed	150

Passive and Active Restoration

Recovery of native vegetation after invasive plant treatment cannot be precisely predicted. Restoration would be considered following repeated herbicide and other treatment methods, especially in areas where recovery to native vegetation may not be possible such as campgrounds and other highly disturbed areas. It is likely that due to the nature of repeated disturbance activities in some areas on the Forest, such as roadsides, long-term site objectives may be focused on containment to prevent future spread into other areas of the Forest but not full restoration of these areas to native vegetation.

Mulching, seeding and planting may be needed to ensure native plant communities can reoccupy treated sites. Restoration and competitive plantings of native flora is essential to long term control of invasive plants. Restoration can be accomplished in some areas by removing competition from invasive plants and allowing native flora to occupy a site. Other areas would require active restoration, which would include mulching, competitive seeding, or planting desirable vegetation. Meadows and forested areas are most likely to respond favorably to passive restoration, while roadsides and other highly disturbed areas may require active assistance through mulching and/or competitive seeding/planting with desirable vegetation. The intent is to re-establish competitive local, native vegetation post-treatment to promote resilient habitat conditions that are less susceptible to invasive plants.

Appendix M of the R6 2005 FEIS emphasizes the role of competitive seeding in restoration:

> "Plan ahead for revegetation. First assess the need for revegetation. It may not always be necessary if a healthy native population is already in place. Not every inch of bare ground needs to be revegetated. If revegetation is needed, make sure you have materials available to seed or plant treated sites as soon after treatment as possible…The planting of competitive desirable species can sometimes be the most effective method of control available for an invasive species."

The Malheur National Forest LRMP (as amended by the R6 2005 ROD) Invasive Plant Standard 13 (table 1) requires that native species be the first choice for revegetation. No noxious weed or invasive plant species would be used for revegetation. A combination of native and desirable non-natives could be an initial mix for revegetation. A fast-growing desirable nonnative such as sterile wheatgrass can germinate quickly and start filling in bare ground until a slower to germinate native species can start competing effectively.

Evaluation for site restoration will occur before, during and after herbicide, manual and mechanical treatments. Passive site restoration would be favored in areas having a stable, diverse, native plant community and sufficient organics in the soil to sustain natural revegetation. If the soils lack sufficient organics, mulch and/or mycorrhizae could be added. Deep-rooted shrubs may also be seeded or planted to more fully utilize resources from the lower soil profile, especially late in the growing season. Shrubs allow for easier establishment of understory species by increasing water availability and reducing understory temperatures and evapo-transpiration.

The degree of disturbance, as indicated by the proportion of the existing plant cover that consists of desirable native species, will also affect revegetation outcome. Ten to twenty percent native cover is considered a minimum required to facilitate natural recovery of a site (James 1992, Sheley et al. 1996, Goodwin and Sheley 2003). The diversity, abundance, and viability of plant propagules of desirable species in the seed bank or within the immediate vicinity are additional important determinants in natural recruitment and recovery.

Draft Guidelines for Revegetation of Invasive plant Sites and Other Disturbed Areas on National Forests and Grasslands in the Pacific Northwest (Erickson et al. 2003) provides information on methods and guidelines for revegetation of invasive plant sites and disturbed areas. Steps are outlined for assessing existing and potential site conditions, and for developing long-term revegetation strategies that are

effective, affordable, and consistent with the ecological context and land management objectives of the site and surrounding landscape. This document promotes the use of local native plant materials to establish competitive plant cover and meet the long-term objective to restore ecosystem functioning.

For this project, active restoration is assumed to be a connected action as needed. We estimate that the 1,281 acres of a size and configuration that might require broadcasting would be the most likely places active restoration could be needed.

Treatment Flexibility and Early Detection and Rapid Response

Alternative B provides for treatment flexibility and early detection and rapid response by providing a method for us to adapt to changes on the ground over time. We expect some populations to increase and others to decrease over the life of this project, depending on many unpredictable factors such as weather (droughts and wet periods), funding, and the location of wildland fires or other uncontrolled disturbances. Under alternative B we will tailor the prescription to ground conditions at the time of treatment.

In addition, new or previously undiscovered infestations could be treated using the range of methods described in this EIS. An EDRR approach is needed because (1) the precise location of individual target plants, including those mapped in the current inventory, are subject to rapid and/or unpredictable change, and (2) the typical NEPA process does not allow for rapid response to new detections; infestations may grow and spread into new areas during the time it usually takes to prepare NEPA documentation. The intent of the project early detection and rapid response approach is to treat new infestations when they are small so that the likelihood of successful treatment is maximized and adverse effects are minimized.

If alternative B is selected, integrated treatments would be authorized for new infestations detected over the next 5 to 15 years, using the treatment methods and project design features evaluated in this EIS. The analysis of alternative B assumes that all of the current infestations are treated in a single year and all pdfs are properly applied.

We expect herbicide use would steadily increase the first few years of implementation of this project; however, we would also reduce reliance on herbicides over time as target invasive plant populations are reduced and desirable vegetation is restored. Newly detected invasive plants are high priority for treatment and herbicides may be used, however we do not expect EDRR to require extensive herbicide treatments. Our intention is to rapidly respond to new detections and treat them while they are small, increasing our chances of success and minimizing the amount of herbicide needed.

Chapter 3.1.5 discusses how the spread of invasive plants is influenced by the intensity and frequency of soil disturbance at a given site, along with the invasive plant propagule pressure associated with nearby vectors (pathway).

The approach is based on the premise that the impacts of similar treatments are predictable, even though the precise location or timing of the treatment may be unpredictable. The project early detection and rapid response approach would allow the Forest Service to treat new infestations using approved methods anywhere on the Forest that the need exists. The implementation planning process detailed in the following section is intended to ensure that pdfs and herbicide-use buffers are appropriately applied and that effects are within the scope of those disclosed in this EIS. FSH 1909.15, chapter 1.8.1 provides guidance of review of ongoing projects to determine if the environmental analysis and documentation should be corrected, supplemented, or revised.

Project "Caps"

These caps provide further sideboards to minimize adverse effects and ensure that the effects of treatments authorized under this EIS are consistent with the analysis disclosed in this EIS. Under alternative B:

- In no case would more than 2,124 discrete acres be treated using herbicides in a single year (based on our existing, site-specific inventory).
- No more than 30,000 acres (including initial and repeat treatments) would be treated using any method over the life of the project. The 30,000-acre cap is based on the current inventory of invasive plants spreading by 10 percent per year over a 15-year period, without any slowing of spread from prevention or treatment. This is an extreme scenario that is unlikely to actually occur.
- No more than 10 percent of the total acres of any 6th field watershed, and no more than 10 acres within 100 feet of any water body in a 6th field watershed would be treated with herbicide in a single year.[11]

The following table shows management objectives for additional target species that may be found under the project early detection and rapid response portion of the project. These include: (1) new invasive plant species that may invade the Forest in the future, (2) invasive species that are known to occur on the Forest, but are not mapped due to their ubiquity, (3) noxious weeds that are not invasive, dominating, or persistent on the Forest, and (4) non-native species that may be treated only when co-occurring with the 18 primary target species we have currently mapped.

[11] Currently, a total of 470 acres of invasive plants lie within 100 feet of a water body. This acreage is scattered mainly along roads within several 6th field sub-watersheds. When the entire infested site acreage is included if any part of the infested area is within 100 feet of a water body, this acreage rises to 1,389.

Table 12. Management objectives under early detection and rapid response

Species Category	Examples	Treatment Objective	Notes
New invasive species/noxious weeds on the Forest.	Class A or B noxious weeds as designated by the State of Oregon or species that are new to the state or North America	Eradicate	New sites will be inventoried and eradicated using Early Detection Rapid Response (EDRR).
Invasive species/noxious weeds/ non-native species that are ubiquitous across landscape	Cheatgrass, medusahead, *Ventenata,* intermediate wheatgrass, *Poa bulbosa,* dandelion, mullein	Tolerate	These species are not inventoried. Some species may be treated if they co-occur with the 18 primary target species, especially where active restoration is prescribed. Additionally, some of these species may be indirectly suppressed with cultural methods on a site specific basis. For example, permitted livestock grazing may occur in cheatgrass-dominated areas in an attempt to suppress the vigor of the infestation. However, this would be dealt with during Allotment Management Plan revision or the Annual Operating Instructions.
Non-native species/noxious weeds that occur sporadically on the Forest, but are not invasive and have not been observed to dominate or persist at sites	Tansy ragwort, rush skeletonweed, oxeye daisy	Tolerate & Monitor	These species are either not inventoried or the existing inventory is incomplete and inaccurate. Adjust treatment objectives through adaptive management if species are becoming invasive (e.g. spreading, displacing native species, disrupting ecosystem processes). Some may be treated if they co-occur with the 18 primary target species. Manual treatments may occur if sites are encountered during other related fieldwork.

Implementation Planning

This section outlines the process that would be used to ensure that the selected alternative is properly implemented. The methodology follows integrated weed management principles (R6 2005 FEIS, 3-3) and satisfies pesticide use planning requirements at FSH 2109.14. It applies to currently known infestations and new sites found within or outside currently mapped treatment areas during ongoing inventory. Appropriate Forest Service staff would develop annual treatment prescriptions to ensure that project design features are appropriately incorporated. This process applies to invasive plant treatments planned as a part of other projects (such as a mitigation measure associated with a thinning or road decommissioning) or on a stand-alone basis. The priority, strategy and timing of treatment are influenced by the potential for disturbance, especially where seed beds are in the soil and invasive plant growth may be triggered by the disturbance. See chapter 3.1.5 for more information about the spread of invasive plants along identified vectors. The range of treatment methods considered herein are based on effective treatments (common control measures, see table 8) needed for the current inventory of 18 primary target species across the Malheur National Forest. New situations could lead to the need for additional integrated treatment methods. Treatments outside the scope of this alternative would not be authorized under this decision.

1. Characterize invasive plant infestations to be treated

1. Identify target species, location, density, and extent.
2. Identify adjacent land uses and vectors for invasive plant spread
3. Determine treatment objective and priority.

2. Develop site-specific prescriptions

- Consider whether active restoration may be necessary
- Review the common control measures and update as needed using Integrated Weed Management principles. Identify effective integrated treatment method depending on the target species and surrounding environment.
- Determine whether herbicides are needed and which application method is needed based on the biology of the target species and size and distribution of the infestations. See figure 4 below showing how the decision to use herbicides would be made on a case by case basis.
- Apply appropriate pdfs based on:
  - Past treatment history and response to past treatment
  - Proximity to species of local interest or their habitats
  - Proximity to streams, lakes, wetlands
  - Proximity to vectors and potential for persistent disturbance;
  - Surrounding National Forest land uses and activities
  - Soil conditions
  - Municipal watersheds and/or domestic water intakes
  - Recreation areas, special forest product and special use areas
  - First-choice or other effective herbicide
  - Application rate and method

Once the treatment prescription has been refined, we will:

- Complete Form FS-2100-2 Pesticide Use Proposal. This form lists treatment objectives, specific herbicide(s) that would be used, the rate and method of application, and pdfs that apply.

- Determine need for pre-project surveys for species of local interest and/or their habitats.
- Coordinate with adjacent landowners, water users, agencies, partners, and tribal governments.
- Initiate public notification

3. Accomplishment and Compliance Monitoring

- Develop a project work plan for herbicide use as per FSH 2109.14.3. This work plan presents organizational and operational details including the precise treatment objectives, equipment, materials, and supplies needed; the herbicide application method and rate; field crew organization and lines of responsibility; and interagency coordination.
- Ensure contracts and agreements include appropriate prescriptions and that herbicide ingredients and application rates meet label requirements, R6 2005 ROD, and site-specific pdfs. Contracts and agreements will include the appropriate PDFS, herbicide-use buffers, including herbicide and additive limitations.
- Document and report herbicide use and certified applicator information in the National pesticide use database, via the Forest Service Activity Tracking System (FACTS). A pesticide use report extracts data from FACTS.

4. Post-treatment Monitoring and Recurring Treatments

- Monitoring would occur during implementation to ensure Project Design Features are executed as planned. Post-treatment reviews would occur to determine whether treatments are effective and whether or not passive/active restoration is occurring as expected.
- Contract administration and other existing mechanisms would be used to correct deficiencies. Herbicide use would be reported as required by the FSH 2109.14 and FACTS.
- Post-treatment monitoring would also be used to detect whether pdfs were appropriately applied, and whether non-target vegetation impacts were within tolerable levels.
- Prescriptions would be refined over time based on post-treatment results as long as treatments remain within the scope of the EIS. For instance, an invasive plant population treated with a broadcast herbicide may be retreated with a spot spray, or later manually pulled, once the size of the infestation is sufficiently reduced following the initial treatment. Another example would be the use of another herbicide if the first choice is not effective.
- Treatment buffers would be expanded if damage was found outside herbicide-use buffers as indicated by a decrease in the size of any non-target plant population, leaf discoloration or chlorophyll change, or mortality to individual species of local interest or non-target vegetation. The findings would be applied to herbicide-use buffers for waterbodies. Herbicide-use buffers may be adjusted for certain herbicides/application methods and not others, depending on results.
- See discussion about monitoring earlier in this chapter for additional information.

The Decision to Use Herbicides

The following figure displays a series of questions to be answered during implementation show situations where herbicide would be applied and how in general, pdfs would be considered in the prescription process. This figure applies to currently known infestations and new sites found within or outside currently mapped treatment areas during ongoing inventory. If the target invasive species population is not associated with a size, phenology, density or distribution that warrants herbicide use (alone or in combination with other methods), or if herbicide use does not substantially increase treatment efficiency (considering the availability of volunteers if needed), then non-herbicide methods would be favored.

The Decision to Use Herbicides

Is the target invasive species population associated with a size, phenology, density or distribution that warrants herbicide use (alone or in combination with other methods)?

Yes: To determine appropriate herbicide, review common control measures coupled with local experience. Use first choice or other effective herbicides based on their properties, risks, label directions and project design features. Consider non-target vegetation surrounding treatment sites and use more selective herbicides as appropriate. Consider soil conditions at the treatment site. Consider previous treatments that have occurred on the site. Were they effective? Would another herbicide or combination of methods be more effective? Consider wildlife habitats in the area and implement seasonal restrictions if required. Consider proximity to water and fish species of conservation concern.

No: Would use of herbicides substantially increase cost-effectiveness of treatment? Consider whether volunteers may be available to reduce the cost of manual treatments.

> **Yes:** To determine appropriate herbicide, review common control measures coupled with local experience. Use first choice or other effective herbicides based on their properties, risks, label directions and project design features. Consider non-target vegetation surrounding treatment sites and use more selective herbicides as appropriate. Consider soil conditions at the treatment site. Consider previous treatments that have occurred on the site. Were they effective? Would another herbicide or combination of methods be more effective? Consider wildlife habitats in the area and implement seasonal restrictions if required. Consider proximity to water and fish species of conservation concern.
>
> **No:** Use non-herbicide (manual, mechanical biological or cultural) methods.

Process for Prescribing Broadcast Herbicide Application Method

Do the size, density and/or distribution of invasive plants warrant broadcast application?

No: Use application methods other than broadcasting

Yes: Is the Site within 100 feet of streams and water bodies? Does the area provide habitat for fish species of conservation concern?

> **Yes:** Apply buffers and other pdfs as appropriate. If broadcast is no longer an acceptable method given pdfs, choose an application method other than broadcasting.
>
> **No:** Are there botanical species of conservation concern within 100 feet of the proposed broadcast site? If yes, survey as needed within suitable habitats. Apply botanical buffers as appropriate. Broadcast may still be acceptable if botanical species of conservation concern are covered by barrier. Apply remaining project design features. If broadcast is no longer an acceptable method, choose an application method other than broadcasting.

Figure 4. Questions that facilitate the decision for using herbicides

Monitoring

Under alternative B, we would continue to monitor invasive plants and treatments according to national and regional Forest Service policy. Monitoring is very important because this is an adaptive management project that is expected to last 5 to 15 years. Our monitoring approach is described in the bullets below:

- We would continue to inventory (catalog and map) invasive plant presence using established Forest Service protocols ((NRM 2013);
- We would ensure that higher-risk projects with potential to impact species of conservation concern are properly implemented, and that adverse effects are minimized according to the R6 2005 invasive plant monitoring framework and subsequent monitoring plans (a copy of the current R6 Invasive Plant Monitoring Plan is in the project record);
- We would assess the potential for chemicals and sediment to reach streams and impact water quality according to the R6 2005 Monitoring Framework and subsequent monitoring plans along with monitoring associated with National Water Quality Best Management Practice (BMPs). We would follow established monitoring protocols for chemical use and other projects that may impact streams, water or riparian habitats. We would increase herbicide-use buffers, reduce herbicide application rate, or change treatment method should we find unexpected adverse effects.
- We would monitor treatment effectiveness as part of our annual accomplishment reporting. In accordance with national policy, at least 50 percent of all invasive plant treatments are monitored on the ground to determine treatment effectiveness. We would likely revisit most if not all treatment sites to determine need for follow up until the site is fully restored to its desired condition (depending on the capability of the site, the surrounding land uses, the nature of the infestation, and other factors – please see our implementation planning process outlined later in this chapter).
- We would ensure that herbicide-use buffers and design features are being properly implemented. If not, we would immediately adjust treatments to ensure proper implementation. In addition, if we find unexpected adverse effects despite proper implementation, we would adjust the herbicide-use buffers and design features until the effects are no longer occurring.

2.3.3 Alternative C – Strict Limitations on Herbicide Use

Introduction

We developed alternative C in response to some public concerns about herbicide use on the Malheur National Forest. Alternative C would impose strict limitations on our ability to use herbicides to treat invasive plants. Compared to alternative B, alternative C would address public concerns about herbicide impacts to human health, non-target vegetation, pollinators, potential water contamination, and herbicide effects on fish and wildlife while still allowing for some herbicide use. About 735 acres would be approved for spot/selective herbicide use and on the remaining 1,389 acres, no herbicide would be used.[12]

[12] This assumes that no herbicide would be used within the entire infested area if any part of the area is within 100 feet of a stream or water body, or 200 feet of a well-source area.

Forest Plan Amendment

Alternative C would include the same Forest Plan amendment as alternative B.

Integrated Treatment Methods

Alternative C would include all of the integrated treatment methods listed for alternative B except broadcast treatment would not be authorized.

Integrated Treatment Prescriptions

- Alternative C would include greater reliance on non-herbicide methods. Picloram would be eliminated from the list of available herbicides based on public concerns about persistence and mobility in soils.

Project Design Features

Under alternative C, all of the alternative components project design features for alternative B would be followed, except that pdfs related to broadcast spraying and picloram use would become non-applicable.

Herbicide-Use Buffers

No herbicide use would be allowed within the boundaries of any mapped infested area that at any point is within 100 feet of creeks, lakes, ponds and wetlands; or 200 feet of well source areas. Non-herbicide methods would continue to be used within of these areas. The buffer tables associated with alternative B would become non-applicable since no herbicide use would be allowed within 100 feet of streams.

Passive and Active Restoration

Restoration would be the same as described for alternative B.

Treatment Flexibility and Early Detection Rapid Response

Alternative C would provide for treatment flexibility through the life of the project. Newly detected infestations could be treated according to the pdfs associated with this alternative. No broadcast treatments, use of herbicides within 100 feet of streams, or use of picloram would be authorized for future year treatments. Selective and spot treatment of herbicide would be limited to no more than 735 acres per year, or total 11,025 acres over the life of the project.[13] The total of non-herbicide and herbicide methods would not exceed 30,000 acres over a 15-year period.

These restrictions would apply to known sites as they change over time, as well as new detections. The implementation planning process would be similar to alternative B, however the range of treatments that would be allowed and the places, types and amounts of herbicide that may be used would be more restrictive. Table 13 summarizes the herbicides ingredients that are likely most effective in alternative C, based on the target species within the mapped infested areas and the restrictions on herbicide use in this alternative.

[13] This acreage is based on total acres in any infested site for which any portion is within 100 feet of a stream. There are additional waterbodies that would be buffered (approximately 63 acres fall within 100 feet of a lake, pond or wetland and are more than 100 feet from a stream). These are not included in the no herbicide acreage. Any ponds or wetlands that are found during implementation would be buffered appropriately.

Implementation Planning and Monitoring

The implementation planning process and monitoring requirements would be similar to alternative B. Questions to facilitate the use of herbicides would not include questions leading to decisions about whether or not to use the broadcast application method.

Table 13. Summary of herbicide and non-herbicide use under alternative C

First Year/First Choice Activity	Acres
Herbicide Active Ingredient	
Aminopyralid	560
Chlorsulfuron	142
Metsulfuron methyl	33
Total Spot/Selective Herbicide Application	735
Total Non-herbicide Treatment	**1,389**

2.3.4 Alternative D – No Forest Plan Amendment, No Aminopyralid

Introduction

Alternative D was developed to evaluate the tradeoffs involved with adding aminopyralid to the list of available herbicides for use on the Malheur National Forest.

LRMP Amendment

No LRMP amendment is proposed for this alternative.

Integrated Treatment Methods

All treatment methods listed for alternative B would be approved.

Integrated Treatment Prescriptions

Integrated treatment prescriptions would be similar to those listed for alternative B except that no aminopyralid would be used to treat known sites or new detections. Compared to alternative B, more chlorsulfuron, glyphosate, metsulfuron methyl, and picloram would be used in lieu of aminopyralid.

Project Design Features

All of the project design features and herbicide-use buffers associated with alternative B would apply, except for those that refer to use of aminopyralid.

The herbicide-use rates, pdfs and herbicide-use buffers associated with aminopyralid would become non-applicable. Much of the infested sites near streams and other water bodies would be spot treated rather than broadcast as directed by the herbicide-use buffers associated with herbicides other than aminopyralid.

Table 14. Summary of herbicide use under alternative D

First Year/First Choice Activity	Acres
Broadcast Herbicide	
Chlorsulfuron	435
Glyphosate	3
Metsulfuron methyl	69

First Year/First Choice Activity	Acres
Picloram	36
Total Broadcast	543
Selective/Spot by First-choice Herbicide	
Aminopyralid	0
Chlorsulfuron	595
Glyphosate	721
Metsulfuron methyl	238
Picloram	27
Total Selective/Spot	**1581**

Passive and Active Restoration

This component of alternative D would be the same as alternative B.

Treatment Flexibility and EDRR

This component of alternative D would be the same as alternative B, except aminopyralid would not be authorized for use.

Implementation Planning and Monitoring

This component of alternative D would be the same as alternative B, except aminopyralid would not be authorized for use.

2.4 Alternatives Considered but Eliminated from Detailed Study

During scoping, some people suggested alternatives that were considered but eliminated from detailed study because they either did not meet the purpose and need for action or were similar to an alternative considered in this document.

2.4.1 Alternative to Evaluate Effectiveness of Past Treatments by a Third Party

One commenter suggests that effectiveness of past treatments must be evaluated by a disinterested party before new treatments would be implemented. This is an opinion not supported by law or policy and is outside the scope of the analysis in the EIS. It would not address the need for treatment flexibility or rapid response to newly detected infestations. It would not expand the treatment toolbox or bring the program into alignment with Malheur National Forest LRMP guidance. Therefore, this alternative was not developed for detailed study.

2.4.2 Limitations on Herbicide-use Rates for All Herbicides

Some people suggested that maximum rates of any herbicide should not be used in any circumstances. Limitations on certain herbicide ingredients, rates, and application methods are already part of the action alternatives to ensure that the adverse impacts of treatments are minimized. For instance, the lowest amount of herbicide necessary to meet treatment objectives is part of the design of all action alternatives and in some cases rates have been specifically limited to address a specific human health or environmental concern. However, in some situations, maximum label rates could be needed for timely and effective treatment. Thus, a

general limit on application rates was not considered for detailed study because it would not further minimize adverse effects but could impede treatment effectiveness.

2.4.3 Mandatory Decline on Herbicide Use Over Time

Some people suggested an alternative requiring a mandatory decline in herbicide use over time. An R6 2005 ROD objective is to reduce reliance on herbicides over time. This would be accomplished through effective treatment and restoration at any given treatment site. Our intent is to effectively treat invasive plants across the Forest until target populations are at a level that can be maintained with little or no herbicide (see chapter 3.1.4). However, due to uncertainty in funding and workforce capacity, the pattern of herbicide use over time cannot be precisely predicted. Thus, a mandatory decline on herbicide use each year at the project level is not possible and would not meet the purpose and need for timely and effective treatments. Annual and life of the project caps would ensure that herbicide use does not increase over time.

2.4.4 Use of Herbicides as a Last Resort

Use of herbicides as a last resort was considered as an alternative in the R6 2005 FEIS and was rejected in the R6 2005 ROD (p. 27). This decision need not be reconsidered at the project scale.

The Pacific Northwest Regional Forester decided to include use of herbicides as part of an integrated weed management approach to allow for the most effective possible treatment outcome. The common control measures (table 8) display the integrated treatment methods most likely to be effective on the target invasive species currently found on the Forest. Use of non-herbicide methods have not resulted in eradication, control, or containment of the current infestations.

2.4.5 Use of Herbicides for Only the Highest Priority Target Species

Priority for treatment is a function of the invasive plant species as well as its size and location. Site-specific integrated treatment objectives and methods vary depending on the location, size and density of a given infestation. Thus, a prohibition on use of herbicides depending solely on target species would not allow effective treatment in all high priority situations. All action alternatives would only utilize herbicides as necessary to meet treatment objectives. Herbicides would not likely be used in any alternative where target species are widespread, and are effectively suppressed by non-herbicide methods such as biological agents. Thus, this alternative was not developed for detailed study.

2.4.6 No Herbicide Use in a Variety of Areas

One comment letter included a number of suggestions about prohibiting herbicide use in a variety of areas including fish habitat, riparian areas, municipal watersheds, wildlife habitat, areas of wild edible plants, in cultural plant gathering areas, in roadless or other undeveloped areas, and in developed areas like campsites and along trails. When all of the areas are added together, this becomes an alternative very similar to eliminating herbicides from the treatment toolbox and would not meet the purpose and need for timely and effective treatment. Use of non-herbicide methods have not resulted in eradication, control, or containment of the current infestations. For fish and wildlife habitats, disturbance from non-herbicide methods that require more repeated entries would have greater effects than the herbicide use proposed.

Alternative C minimizes use of herbicides and would require non-herbicide methods across the majority of currently infested sites. It includes an annual cap on herbicide use that is much lower than the other action alternatives and addresses many of the suggestions expressed in the scoping

comment letters. Thus, another alternative strictly limiting herbicide use was not developed for detailed study because of its similarity to alternative C.

2.4.7 No Early Detection and Rapid Response

One commenter suggested that new detections should be subject to additional NEPA analysis. This alternative would not meet the purpose and need for timely treatment of new infestations. Thus, this alternative was not developed for detailed study.

2.5 Alternatives Compared

Table 15. Alternative comparison by activity

Activity	Alternative A (No Action)	Alternative B (Proposed Action)	Alternative C	Alternative D
Authorizes EDRR	No	Yes	Yes	Yes
Non-herbicide treatments	None[14]	Non-herbicide treatments would be integrated with herbicide treatments	Same as Alternative B , except only non-herbicide treatments would be approved within 100 feet of water bodies	Same as Alternative B
Maximum acres of proposed herbicide treatments during any year of implementation	0	2,124	735	Same as Alternative B
Total invasive plant treatment acres over the life of the project (includes all treatments and re-treatments)	0	30,000 over 15 years (including herbicide use)	11,025 herbicide 30,000 total all treatments	Same as Alternative B
Number of herbicides available for use	0	11	10 (no picloram)	10 (no aminopyralid)
Forest LRMP amendment to include aminopyralid	No	Yes	Yes	No
Herbicide application rate and method	None	Lowest effective rate, broadcast sprayers may be used where needed according to pdfs	Application rate would not exceed 70% of typical broadcast rate, no boom or broadcast sprayers	Same as Alternative B , no aminopyralid

[14] The analysis in chapter 3 assumes that no action means no invasive plant treatments will occur. Prevention would continue, and biological agents distributed in adjacent lands would naturally distribute to host species within the Malheur National Forest.

Table 16 displays a comparison of the first year/first choice herbicide for each alternative. All action alternatives (B-D) would approve a range of treatments on all 2,124 currently infested acres. Alternative C is the only action alternative that would disallow herbicide use in specific areas to the degree that non-herbicide treatments would be the only methods allowed for these sites. Under alternative A (no action), no treatments would be approved. Under all alternatives (A-D), approved biological controls will continue to be released adjacent to the project area, and would help suppress toadflax, St Johnswort and other common invasive species. Biological controls would be redistributed to host species within the project area in the action alternatives.

Table 16. Comparison of first year/first choice herbicide by alternative

First Year/First Choice Treatment	Alternative A Acres	Alternative B Acres	Alternative C Acres	Alternative D Acres
Broadcast Herbicide Application	0	1,281	0	0
Aminopyralid	0	1,179	0	0
Chlorsulfuron	0	71	0	435
Glyphosate	0	0	0	3
Metsulfuron methyl	0	30	0	69
Picloram	0	0	0	36
Spot/Selective Herbicide Application	0	843	735	1,581
Aminopyralid	0	168	560	0
Chlorsulfuron	0	519	142	595
Glyphosate	0	0	0	722
Metsulfuronmethyl	0	156	33	238
Picloram	0	0	0	27
Non-herbicide Only	0	0	1,389	0

Figure 5 displays how these treatments are distributed within one sample area.

Table 17 provides a comparison of the alternatives relative to the issue measures described in chapter 1.

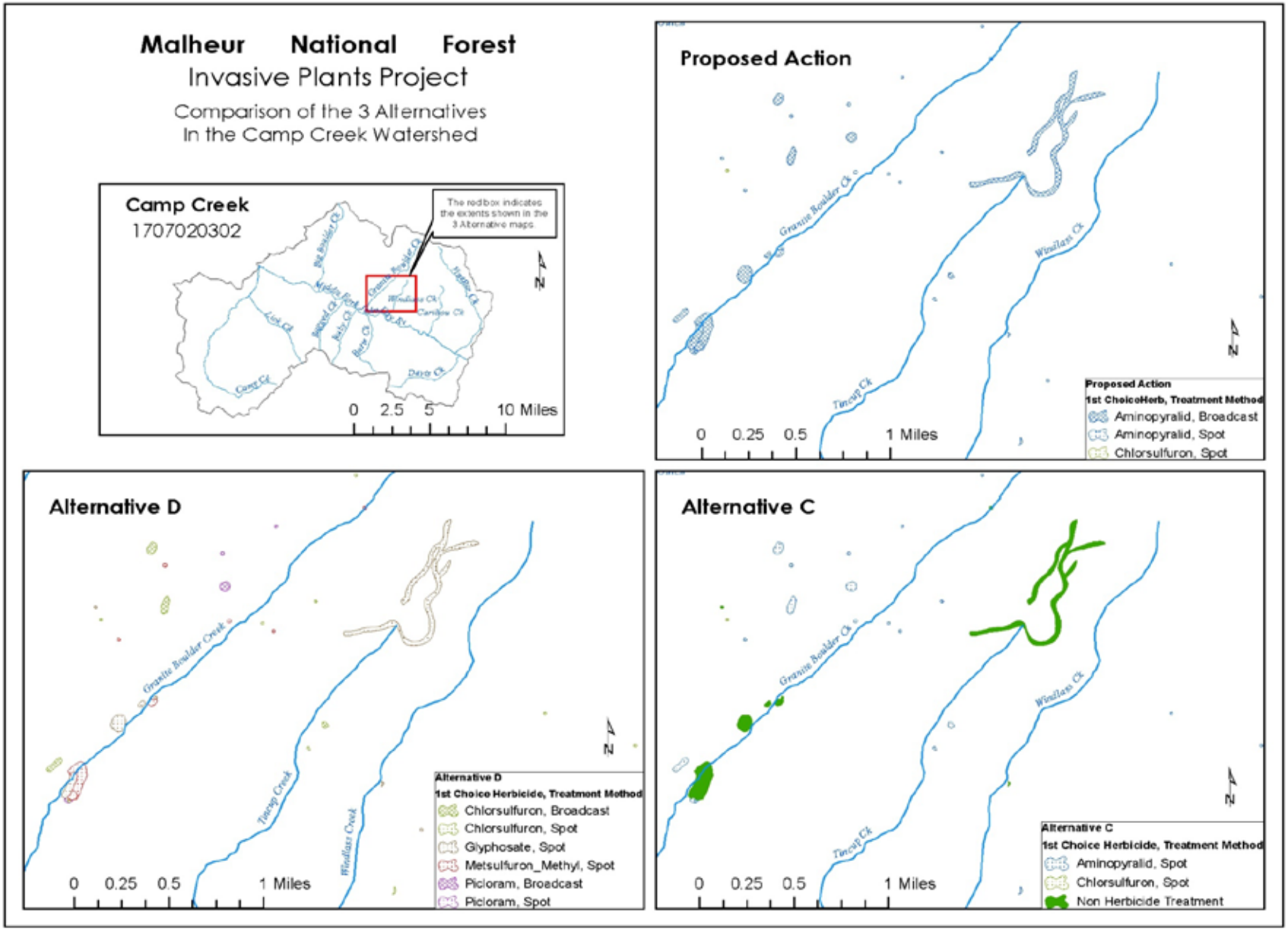

Figure 5. One sample area showing treatment distribution

Table 17. Alternative comparison relative to significant issues

Issue Component	Unit of Measurement	(No Action) Alternative A	(Proposed Action) Alternative B	Alternative C	Alternative D
1 – Treatment Effectiveness					
Unnecessary restrictions on herbicide use reduce treatment effectiveness and increase treatment costs.	Average Cost per Acre of Effective Treatment (includes re-treatments and restoration)	0	$544	$722	$598
	Total Cost of Most Ambitious Treatment Scenario	0	$1,154,000	$1,472,900	$1,270,500
	Maximum Cost over the Life of the Project (assuming maximum treatment caps multiplied by average per acre cost)	0	$16,320,000	$21,660,000	$17,940,000
	Number of Years to Achieve Objectives (most ambitious treatment scenario)	Objectives not achieved	4 years	6 years	5 years
2 – Herbicide Impacts to Human Health					
Human health may be harmed by herbicide exposure.	Type (rate, method, chemical properties) and extent of herbicide use that could result in harmful exposure scenarios to people.	None	None of the herbicides proposed for use are associated with any harmful scenarios to the public. Where necessary, pdfs minimize or eliminate potential for harmful exposure scenarios by limiting the herbicide ingredient, rate, or method of application in specific areas. Workers	Same as Alternative B, except that far less herbicide would likely be sprayed annually. The minimal risks associated with herbicide use under Alternative B would be eliminated.	Same as Alternative B. Where necessary, pdfs minimize or eliminate potential for harmful exposure scenarios.

Issue Component	Unit of Measurement	(No Action) Alternative A	(Proposed Action) Alternative B	Alternative C	Alternative D
			need to take specific precautions to avoid harmful herbicide and NPE exposure.		
	Qualitative assessment about the effectiveness of herbicide-use buffers and other project design features to prevent harmful herbicide exposure scenarios	None	Risk assessments demonstrate that aminopyralid poses very low risk to human health. The likelihood of harmful exposures is low, thus the design features have high likelihood of eliminating all potential adverse impacts from herbicide use.	Alternative C would have less risk of herbicide exposure overall, especially to fish and water, due to restrictions on herbicide use near water. The buffers would eliminate all potential herbicide exposure near streams. While this alternative includes some additional design features that would comparatively reduce risk of harmful herbicide exposure, the risk is already low.	Same as Alternative B, except opportunities to use aminopyralid would be foregone and in some cases, higher risk herbicides would be used. However, more spot treatment and less broadcasting would occur, which could result in less herbicide exposure, partly because less herbicide can be applied per day so the daily treatment extent would likely be less. For the project as a whole, the design features minimize adverse impacts to human health from herbicide use.
	Potential for herbicides to affect drinking water	None	Drinking water quality would not be adversely affected. Restrictions on herbicide use near drinking water and well intakes further minimize risk. Herbicide transportation and handling safety plan would minimize potential for an herbicide spill.	Same as Alternative B	Same as Alternative B
3 – Herbicide Impacts on Non-target Vegetation and Pollinators					
Proposed herbicide use may harm non-target plants and/or pollinators, specifically sensitive and	Type and extent of herbicide use within 100 feet of botanical special species of conservation	None	Project design features prohibit broadcast herbicide use within100 feet of sensitive plant	Same as Alternative B, less overall herbicide use	Same as Alternative B

Issue Component	Unit of Measurement	(No Action) Alternative A	(Proposed Action) Alternative B	Alternative C	Alternative D
other species of conservation concern, cultural use plants, and special forest products.	concern, cultural use plants, and special forest products.		populations. Spot applications will be used within 100 feet of sensitive plant populations. Project design features for use of blue dye will alert special forest product gatherers of herbicide spray areas.		
4 - Herbicide Delivery to Water and Potential Impacts to Fish					
Proposed herbicide use may result in chemicals reaching streams and other water bodies (through drift, leaching and/or run off) and may adversely fish and their habitat.	Type and extent of herbicide use within 100 feet of streams and other water bodies.	none	Aminopyralid could be broadcast up to the water's edge; however no adverse impacts on fish are expected because the amount of herbicide that could reach streams is below a level that could harm fish. Herbicide-use buffers and other pdfs reduce the rate, extent, or frequency of herbicide use that pose potential risks to fish.	Same as Alternative B, except no herbicides would be used within 100 feet of streams and other water bodies. There potentially could be more sediment from non-herbicide methods required near streams.	Same as Alternative B, except comparatively more use of higher-risk herbicides relative to fish. Project design features minimize risks and differences between alternatives.
	Qualitative Assessment about whether or not, and how fisheries might be affected	No impacts	Water concentrations from site-specific model runs at highest risk sites demonstrate that levels of herbicide that could reach streams and aquatic organisms are at least 3 orders of magnitude less than levels of concern for fish and their habitat. All treatment methods may result in minor amounts of sediment reaching streams.	Same as Alternative B	Same as Alternative B
6- Herbicide Impacts on Wildlife					

Issue Component	Unit of Measurement	(No Action) Alternative A	(Proposed Action) Alternative B	Alternative C	Alternative D
Proposed herbicide use may result in harmful exposure to terrestrial wildlife (specifically species of conservation concern).	Type and extent of herbicide use within specific wildlife habitats for wildlife of conservation concern	None	This alternative has the most broadcasting, but the first-choice herbicides that would be used pose low risk to wildlife.	Spot application of herbicides would occur on 735 acres and the first-choice herbicides pose low risk to wildlife.	First-choice herbicides that pose a low risk to wildlife would be applied on 1,337 acres, whereas moderate to risk first-choice herbicides would be used on 787 acres. Less broadcasting than Alternative B, which reduces risk of drift.
	Risk of HCB (hexachlorobenzene) contamination and effects on raptor eggs	None	No PCBs in first-choice herbicides. Project design features minimize risk to raptors to extremely low level.	Same as alternative B. No picloram eliminates risk.	Picloram is the first-choice herbicide on 63 acres, posing low risk of PCB's; pdfs minimize risk to raptors to extremely low level. .
	Narrative assessment about whether or not, and how species of conservation concern and amphibians might be affected	None	All first-choice herbicides pose a low risk to wildlife. Project design features that restrict timing and application of herbicides in sensitive habitats will minimize or eliminate the likelihood for any species to receive a harmful exposure to herbicides or disturbance.	Same as Alternative B, except greater risk of disturbance from non-herbicide treatments.	Same as Alternative B, except less broadcasting and more use of herbicides that pose a comparatively greater risk to wildlife.

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Chapter 3. Affected Environment and Environmental Consequences

3.1. Introduction

3.1.1 The Effects Analysis

Chapter 3 discusses the existing condition within the project area and the direct, indirect and cumulative environmental effects of the alternatives.

- Direct effects are effects that occur at the same time and in the same general location as the activity causing the effects. An example of direct effects is the potential for herbicides to harm non-target plants during applications.
- Indirect effects are those that occur at a different time or location from the activity causing the effects. An example of indirect effects is herbicide that is unintentionally delivered to streams through leaching or overland runoff following one or more storms after treatment (see chapter 3.4 Soils and 3.5 Water Quality).
- Cumulative Effects result from the incremental impacts of the proposed actions/alternatives when added to other past, present, and reasonably foreseeable actions, on the Forest and adjacent lands within 5th field watersheds in the project area. Chapter 3.1.5 provides an introduction to the cumulative effect analysis found throughout chapter 3.

The project area is the 1.7 million-acre Malheur National Forest (Forest), including 240,000 acres of the Ochoco National Forest (previously known as the Snow Mountain Ranger District, now managed as part of the Emigrant Creek Ranger District.) The Strawberry Mountain Range, part of the Blue Mountains, extends east to west through the center of the Malheur National Forest. This range splits the Forest into two geologic provinces, the Columbia Basin to the north and the Great Basin to the south. The Malheur National Forest is bordered by the Wallowa-Whitman National Forest on the east, the Umatilla National Forest on the north, and the Ochoco National Forest on the west. Elevations on the Malheur National Forest vary from less than 4,000 feet to 9,038 feet on Strawberry Mountain. The result is a diverse and productive landscape of grasslands, sage, and juniper; forests of pine, fir, and other tree species and mountain lakes and meadows. The northern part of the Malheur National Forest is drained by the John Day River System into the Columbia River Basin. The southern part is drained, principally, by the Silvies River System into the Great Basin, and by the Malheur River System into the Snake River. There are several lakes and reservoirs on the Malheur National Forest ranging in size from 1 acre to greater than 50 acres.

The project area lies in Grant (1,128,930 acres), Harney (523,066 acres), Baker (46,357 acres), Crook (9,726 acres) and Malheur (605 acres) counties. The Malheur National Forest is within a day’s drive from Portland, Oregon. Principal access routes are U.S. Road 26 and U.S. Road 395, winding two-lane, rural routes. Two main population centers are within the area: the John Day Valley from Dayville to Prairie City, and Burns/Hines.

Invasive plants need to be treated on 2,124 acres within the Malheur National Forest. If the Malheur National Forest Supervisor selects an action alternative, invasive plant treatments would be implemented over several years as funding allows, until no more treatments were needed or until conditions otherwise changed sufficiently to warrant this EIS outdated. Site-specific conditions are expected to change within the life of the project; treated infestations would be reduced in size, untreated infestations would continue

to spread, specific non-target plant or animal species of local interest could change, and/or new invasive plants could become established within the project area.

Chapter 3 discloses the effects of a range of treatment options applied to a range of site conditions to accommodate the uncertainty associated with project implementation. The most ambitious treatment scenario assumes that all 2,124 acres of currently mapped infestations are treated for a period of 4-6 years until control objectives are met. In reality, we are likely to treat fewer acres each year, and treatments are likely to be needed for more than 6 years. Our assumption reflects an ambitious level of treatment that and allows for analysis consistency. Each specialist considers how unpredictable implementation might influence the expected effects.

Assuming full and immediate treatment of all existing infestations, early detection/rapid response (EDRR) would likely be a very small part of the project. However, because the funding level will likely be too low to treat all existing acres, and because some of the primary target species are likely to spread along existing vectors (mainly roads), some of the lower priority existing infestations will not be treated in the near future. Treatment of new detections is one of our highest priorities in all action alternatives.

The common control measures (table 8), project design features (table 9) and herbicide-use buffers (table 10 and table 11), and the implementation planning process (figure 4) provide sideboards that minimize and bound the potential for effects even though the suite of integrated treatments would vary each year.

Figure 2 in chapter 2 shows the current extent of invasive plants and their distribution through the 5th field HUC watersheds on the Malheur National Forest. Appendix A contains a report showing specific locations and descriptions of invasive plants within the 5th field HUC watersheds.

3.1.2 Herbicide Risk Assessments

The effects from the use of any herbicide depend on the toxic properties (hazards) of that herbicide, the level of exposure to that herbicide at any given time, and the duration of that exposure. Herbicide risk assessments were the basis for analysis in the R6 2005 FEIS, disclosing the potential for effects on non-target plants, wildlife, human health, soils and aquatic organisms. Risk assessments were done by Syracuse Environmental Research Associates, Inc. (SERA) using peer-reviewed articles from the open scientific literature and current Environmental Protection Agency (EPA) documents, including Confidential Business Information. 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 organisms. See table 7 in chapter 2 for the list of current SERA risk assessments.

In addition to the analysis of potential hazards to human health from every herbicide active ingredient, Forest Service/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 FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act).

In some cases, toxicity data on inerts and adjuvants is produced to comply with other federal laws that regulate non-herbicide uses of these chemicals, such as the Federal Food, Drug, and Cosmetic Act.

The risk assessments considered maximum exposure scenarios including accidental exposures and application at maximum label rates. The project design features described in chapter 2 were developed to abate hazards indicated by the assessments. Although the risk assessments have limitations (see R6 2005 FEIS pages 3-95 through 3-97), 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.

Herbicide Toxicity Terminology

The following terminology is used throughout this chapter to describe relative toxicity of herbicides proposed for use in the alternatives.

Hazard Quotient (HQ)

The ratio of the estimated level of exposure to a substance from a specific pesticide application, to the level of the acceptable exposure or toxicity. A HQ less than or equal to one is presumed to indicate an acceptably low level of risk for that specific application.

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.

Plausible Effects

The analysis in chapter 3 focuses on whether effects that are possible based on risk assessments are plausible, given site conditions, life history of organisms in an area, herbicide application methods and other project design features. Project design features (table 9) are often used to minimize or eliminate the plausibility of effects indicated as possible in the risk assessments.

Herbicide Comparison Table

The following table was prepared by Bautista and Bulkin in 2008. It provides a simple comparison of the relative risk of the 11 herbicides that could be used in this project. This shows how favorably aminopyralid stacks up in comparison. However, the R6 2005 ROD already approved the other herbicides, due to their effectiveness on invasive plants known in the region, the relatively low risks associated with these herbicides, and our ability to mitigate risks to people and the environment (R6 2005 ROD). In this project, exposure scenarios that could be associated with the higher risk ranking for some herbicides have been eliminated through the project design features, herbicide-use buffers, and adaptive implementation planning process described in chapter 2. Each of the action alternatives would utilize different herbicides and application methods as first choice for the first year of treatment, depending on the design of that alternative. First-choice herbicides are indicated in bold.

Table 18. Herbicide risk comparison table

Comparative Risk Level	Public Health	Worker Health	Non Target Plants	Aquatic Organisms	Wildlife
Low	**chlorsulfuron**; **metsulfuron methyl**; sulfometuron methyl; **aminopyralid**	**chlorsulfuron**; clopyralid; **glyphosate**; imazapic; imazapyr; **metsulfuron methyl; aminopyralid**	clopyralid; **picloram**; sethoxydim, triclopyr	clopyralid; imazapic; **metsulfuron methyl**; **aminopyralid**,	**chlorsulfuron**; clopyralid; imazapic; imazapyr; **metsulfuron methyl; aminopyralid**
Moderate	clopyralid; **glyphosate**; imazapic; imazapyr; **picloram**; sethoxydim; triclopyr	**picloram**; triclopyr	**chlorsulfuron**; **aminopyralid; metsulfuron methyl;** sulfometuron methyl; imazapic, imazapyr (somewhat selective)	**chlorsulfuron;** imazapyr; sulfometuron methyl	**glyphosate**; **picloram**

Comparative Risk Level	Public Health	Worker Health	Non Target Plants	Aquatic Organisms	Wildlife
Higher	--	--	**glyphosate**	sethoxydim; **glyphosate**; **picloram**; triclopyr	triclopyr

3.1.3 Site Types

We stratified the existing invasive plant sites into "site types" to help characterize the pattern of infestation and make predictions about future spread (see section 3.1.5 for a discussion about vectors of invasive plant spread in the context of cumulative effects analysis). The majority of mapped invasive plant sites are within 50 feet of roads. This is due to two primary factors: 1) we often look for invasive plants along roads; funding for surveys off roads is limited, and 2) roads are a major vector for the spread of invasive plants. In the following table, if any part of an invasive plant site (polygon) meets the criteria, then that site falls within the given site type. The table also shows the number of actual acres that meet the criteria (portions of invasive plant sites that do not meet the criteria are excluded). Most of the infestations near streams are also along roads.

Table 19. Site type criteria and acres

Site Type ID	Criteria	Number of Infested Sites	Total Number Of Infested Acres If Entire Infested Acreage is Included (within and outside criteria)	Number of infested Acres that Meet Criteria (portions of infested sites)
1	Within 50 ft. of existing, not decommissioned roads	2,252	1,868	1,178
2	Within 100 ft. of existing, not decommissioned roads	2,495	1,950	1,491
3	Within 50 ft. of all roads including decommissioned roads	2,301	1,904	1,244
4	Within 100 ft. of all roads including decommissioned roads	2,552	1,983	1,572
5	Within 25 ft. of trails	91	94	21
6	Within 25 ft. from all streams and ditches	589	1,199	117
7	Within 100 ft. from all streams and ditches	1,045	1,389	462
8	Within wildfire boundaries < 30 years old	409	451	246
9	BAER Inventory (outside wildfire boundaries)	93	38	39
10	Within timber harvest boundaries less than 30 years old	1,467	1,419	729
11	Within 100 ft. of a recreation site	7	20	< 1

3.1.4 Treatment Costs and Effectiveness

This section addresses the cost and effectiveness of treatment under the action alternatives over a 5-year period. While the life of the project is expected to last more than 5 years (5 to 15 years given anticipated budgets), the most ambitious conceivable project, should funding be available, would result in treatment and restoration of all currently known infestations. Assessing this most ambitious conceivable project for

each alternative allows us to derive an average cost per acre that can be applied to the life of the project and annual caps, thus accounting for new detections found over time.

The design of each alternative influences the cost of eradicating, controlling, and containing invasive plants on the Malheur National Forest. For acres where the first-choice herbicide or application method are not allowed due to a particular design feature (such as no broadcasting in alternative C and no aminopyralid use in alternative D), a loss of effectiveness and economic efficiency is predicted. This would increase costs and could compromise our ability to control or eradicate populations of certain aggressive target species, such as thistles and knapweeds (especially near streams).

This analysis demonstrates that a consistent budget over a series of years is needed to meet our invasive plant treatment and restoration objectives. Far less treatment has historically occurred on an annual basis than would be needed to reach objectives in the compressed time frame shown below.

Each treatment entry would reduce the size or density of treated populations. The effectiveness of each treatment is influenced by the tools available for use; the more tools available, the greater the potential effectiveness of the treatment. If the toolbox is restricted and some situations cannot be effectively treated, the percentage of target population killed each year can be dramatically decreased. On page 4-18, the R6 2005 FEIS notes that “In general, alternatives that have the widest variety of herbicides and herbicide families available for use have the greatest potential to result in effective treatments.” In contrast, when herbicide use is more restricted, “…fewer acres would likely be achieved at a constant budget, and the years to control increases proportionally” (ibid. page 4-21). Thus, a loss of effectiveness is likely if the most effective choice is not available for a given site.

Botanists and invasive species specialists across the region have estimated that each treatment entry, 80 percent of the existing target plants would be removed; assuming fully effective integrated weed management methods are available (Desser 2007). Thus, the model assumes population size would decrease by an average of 80 percent on any effectively treated acre. Although the density of target plants would be reduced, the gross number of infested acres could decrease or stay the same. However, we express the 80 percent effectiveness concept as a decrease in the number of acres estimated to need treatment each year.

For instance, a 100-acre infestation effectively treated in year 1 would result in 20 acres needing treatment in year 2. These 20 acres treated in year 2 would result in 4 acres still needing treatment in year 3, and so on until the area needing retreatment is so small as to be uncountable. While we apply this assumption to acres, we are not likely to change any polygon (infested site) boundaries until we are certain we have met our invasive plant treatment objectives for the site. In many cases, there would more likely be 80 percent less density of invasive plants within the infested area than 80 percent fewer acres.

For this analysis, we assume all infested sites are covered with 100 percent invasive plants, because density is a variable that changes rapidly and is unpredictable. Each year, effective treatments are assumed to reduce the treated acreage 80 percent.

The 80 percent estimate is not precise and the range of results varies widely depending on the target, how long the invasive population has been established, the objectives of treatment, and other conditions (monitoring results, funding, topography, soils, weather during time of treatment, and many other variables). Robin Dobson, Ecologist for the Columbia River Gorge National Scenic Area confirmed the 80 percent estimate based on his personal experience in the field (ibid.). Dobson noted that some retreatment was necessary for at least 3 to 5 years to eradicate or control established invasive plant sites. Remnant target plants and seed banks can remain for several years but after four consecutive entries, invasive plants at any given site would be drastically reduced.

This analysis assumes that all known infestations are treated the first year following a decision on this project, and then treated in three to five subsequent entries over a total of 3-5 years. Active restoration is also modeled (year 4, 5, or 6 depending on alternative) to help protect bare areas from reinfestation.

Assuming the most effective treatment tools are available, populations could be reduced from the current 2,124 acres to approximately 23 acres after 4 years (see alternative B). The financial efficiency model adds one more calculation to account for the spread of invasive plants during the life of the project, using a fixed rate of 10 percent per year (based on the R6 2005 FEIS, spread rate estimates range from 4 to 12 percent per year). The rate of spread would not be influenced by the alternatives, but the remnant population subject to spread would vary depending on the effectiveness of each year's treatments.

A consistent cost of $200 per acre was used regardless of treatment method. The site-specific combination of methods and their juxtaposition vary depending on many factors that a more specific estimate is not available. For this analysis, the difference in cost of the project for each action alternative is a function of the effectiveness of each alternative (and the amount of repeated treatments needed) rather than the base cost per acre of a given treatment method.

Alternative Comparison

The alternatives vary as to the first year/first choice herbicides, and these differences influence cost and effectiveness over time. The more effective the first year/first choice herbicide, the less retreatment would be needed. The design of alternatives C and D require that non-herbicide, spot or hand treatments may be required for areas that could more efficiently be broadcast, which would increase the cost of treatment in that alternative.[15] The primary differences between the alternatives and the influence on cost-effectiveness are:

1) *Whether or not aminopyralid may be used as the first-choice herbicide*. Aminopyralid is the first-choice herbicide to treat 1,350 acres (64 percent) of the primary target species found on the Forest. In alternative B, we could broadcast this herbicide almost everywhere needed on the Forest, including to the water's edge. In alternative C, we would spot apply this herbicide to 560 acres, except within 100 feet of stream or other water bodies.

   We would not use this herbicide in alternative D. This increases the amount of spot or hard treatment required in alternative D due to the herbicide-use buffers associated with all herbicides except aminopyralid. The requirement to spot or hand treat, rather than have the broadcast tool, is estimated to decrease the effectiveness of each year's entry from 80 percent to 40 percent.[16]

2) *Restrictions on herbicide use and method.* The herbicide application rates and methods approved influence our ability to effectively treat invasive plants. Alternatives B and D approve broadcast spraying and some use of herbicide near streams. Alternative C does not approve any broadcast spraying and does not allow more than 70 percent of the maximum herbicide label rate to be sprayed on a given acre. It also excludes herbicide use over much of the infested area. This is estimated to reduce effectiveness to 40 percent from 80 percent, in effect doubling the time and cost for this alternative.

[15] This assumption leads to the greatest differences between alternatives compounded over time and provides a reasonable alterantive comparison, but there are too many variables to more precisely predict the costs and effectiveness of treating invasive plants on the Forest over time.

[16] Broadcast methods accomplish many more acres a day than spot or hand methods. Spot and hand treatments tend to require more labor as applicators must walk from spot to spot and then return to accommodate skips and gaps that are common with this type of treatment.

Also the effectiveness would decrease by half on the portion of alternative D that requires spot or hand treatment rather than allowing broadcast, due to the elimination of aminopyralid (explained previously). This reflects the need for repeated entries to accommodate skips and gaps and the increased amount of labor needed to accomplish the manual, mechanical and spot herbicide work. This is especially true for large infestations with high densities of invasive plants.

3) *Whether or not picloram may be used.* Alternatives B and D allow picloram and alternative C does not. Alternative D includes the use of picloram as the first-choice herbicide on 63 acres (or about 3 percent of the total infested acreage). Because alternative C does not approve the use of picloram, there will be an unquantifiable loss of effectiveness for those acres where picloram is one of the effective herbicides. About 1,697 (80%) of the existing infested acres are occupied by target species where picloram is listed as an effective choice (table 8, chapter 2); however, picloram would likely be the "second choice" herbicide on a small portion of these acres.

Alternative A

Under alternative A, no invasive plant treatments would occur so no funds would be expended. However, invasive plants would continue to spread at a rate from 4 to 12 percent per year (R6 2005 FEIS and ROD). Prevention measures would be applied to new projects and ongoing activities and would be expected to slow the rate of spread over time (ibid.); however, existing infestations would not be treated under this decision. The purpose and need for action would not be met and the degrading impacts of invasive plants, explained in all of the resource sections of chapter 3 would continue unabated.

Isolated populations of invasive plants, particularly the knapweeds, Dalmatian toadflax, and sulphur cinquefoil, can quickly spread into adjoining forest lands if the Forest canopy is opened up. Seeds of invasive plants can be carried some distance by passing traffic, equipment, wind, and animals. Alternative A continues the current the risk for invasive plant propagules to spread. Chapter 3.1.5 lists associated activities, intensity and frequency of disturbance and level of noxious weed propagule pressure. Since most of the current weed sites occur near roads, the risk for increased spread from lack of treatment is highest along these routes. Roads and recreation areas have perpetual disturbance, a non-natural habitat that favors opportunistic invasive species and a high rate of propagule pressure.

Alternative B

Alternative B allows for the most effective, available treatment methods to occur on the existing infestations and future detections, thus the first year/first choice treatment for each infested area under alternative B is assumed to be 80 percent effective.

The most ambitious treatment scenario would treat all 2,124 acres within a year of this decision being signed (2014-2015 or year 1). The following year 20 percent of the acreage would need to be retreated (425 acres 2015-2016 or year 2). These remaining acres would be subject to spread, so a rate of 10 percent spread per year was applied on the remaining acres. Thus, about 468 acres would be treated in the years 2015-2016 and given the 80 percent effectiveness on these acres; about 94 acres would need to be treated in 2016-2017 (year 3). Thus, about 103 acres would be treated in year 3 once 10 percent spread rate is applied. Under the most ambitious treatment scenario, these 103 acres would be reduced to about 21 acres by 2018 (year 4). This would be considered a nominal level, so the treatment cost-effectiveness analysis is not carried out further, except to accommodate the cost of active restoration.

Passive restoration would be adequate on most of the treated sites; however some areas will need to be seeded, mulched or planted once invasive species are removed. For the most ambitious treatment scenario, I estimated that the 1,231 acres that are of a size and configuration that could require broadcast treatment would need some sort of active restoration (mulching, seeding, planting), at a rate of $500 per

acre[17] applied year 4 (2018). This is a high estimate and likely passive restoration would suffice for many of these areas. However, this estimate accurately characterizes the potential for high costs of repeat treatments and restoration of invasive species over time. The surrounding vector of spread and propagule pressure would influence the need and extent of active restoration. Perpetual disturbance associated with recreation, livestock grazing, and roads could complicate restoration.

In some cases, restoration of native vegetation would be part of another ongoing or planned project, such as road decommissioning, stream restoration, and restoration of yarding corridors associated with timber. Road closures could make restoration and long-term maintenance of invasive plants more difficult.

Cooperative treatments between neighboring land owners and agencies involved with invasive plant management would increase the effectiveness of alternative B and ensure weed spread between land ownerships is properly abated.

Table 20 shows the costs per year, total cost over a 4-year period, and average cost per acre to be applied to unpredictable new infestations that could be discovered and treated over the life of the project according to common control measures, pdfs, and subject to treatment caps.

Table 20. Most ambitious treatment scenario and costs for alternative B

	Acres Treated	Acres Remaining to Be Treated	Add 10% spread rate	Cost Year 1
Year 1	2,124	425	468	$424,800
Year 2	468	94	103	$93,600
Year 3	103	21	23	$20,600
Year 4 – restoration	1,231	Maintenance level	NA	$615,500
Total				**$1,154,500**
Average Cost per Acre with all activities included				$544
Applied to 30,000 acre life of the Project Cap For EDRR				Maximum of $16,320,000 over a fifteen year period

Alternative C

Alternative C restricts available treatment methods for both the existing infestations and future detections and thus reduces its effectiveness. The loss of the ability to use herbicides/broadcast spray in this alternative is estimated to reduce the effectiveness of treating all existing infestations to half of alternative B based on these restrictions. In addition, the potential effectiveness would be reduced due to the lack of picloram in the toolbox. The loss of the use of picloram would reduce our ability to effectively adapt to areas that do not effectively respond to aminopyralid or another first year/first choice herbicide.

The most ambitious treatment scenario would treat all 2,124 acres within a year of this decision being signed (2014-2015 or year 1). The following year, half of this acreage would still need to be treated and would be subject to annual spread. Table 21 shows how this would compound over time and increase the life of the project cost. Restoration costs are the same across the action alternatives.

Cooperative treatments between neighboring land owners and agencies involved with invasive plant management would increase the effectiveness of alternative C.

[17] Restoration cost based on estimates in the GPNF EIS, Gifford Pinchot National Forest, 2008

Table 21 below shows the costs per year, total cost over a 6-year period, and average cost per acre to be applied to unpredictable new infestations that could be discovered and treated over the life of the project according to common control measures, pdfs and subject to treatment caps associated with alternative C.

Table 21. Most ambitious treatment scenario and costs for alternative C

	Acres Treated	Acres Remaining to Be Treated	Add 10% spread rate	Cost Year 1
Year 1	2124	1062	1168	$424,800
Year 2	1168	584	642	$233,600
Year 3	642	321	353	$128,400
Year 4	353	177	195	$70,600
Year 5	195	98	108	$39,000
Year 5	108	54	59	$21,600
Year 6 - restoration	1,231	Maintenance level	NA	$615,500
Total				$1,533,500
Average Cost per Acre with all activities included				$722
Applied to 30,000 acre life of the Project Cap For EDRR				Maximum of $21,660,000 over a fifteen year period

Alternative D

Alternative D restricts available treatment methods for both the existing infestations and future detections and thus reduces its effectiveness. The loss of the ability to use aminopyralid in this alternative is estimated to reduce the effectiveness of treating about 1,347 acres. Because aminopyralid can be broadcast to the water's edge, and other herbicides cannot, about 738 acres would have to be spot applied in alternative D, rather than broadcast. This would increase the time and thus the cost of treating these acres. The loss of aminopyralid itself would also have an effect on making alternative D less effective but this was not included in the economic analysis. The main effect of alternative D that was modeled is the difference in spot versus broadcast acreage. Restoration costs would remain the same as alternative B and C.

The economic analysis assumes equal effectiveness between alternatives B and D for 1,386 acres (80% effective per year). However, it reduces the effectiveness by half for those 738 acres that must be spot or hand treated in alternative D (rather than broadcast sprayed) due to the herbicide-use buffers on herbicides other than aminopyralid that restrict broadcast spraying near streams. Spot treatment is considered half as effective as broadcast because of the greater amount of time spent by workers walking from invasive plant to invasive plant, rather than a uniform application. Where spot treatment is required for areas that are 100 percent covered by invasive plants (our analysis assumption for the currently mapped infestations), there will also likely be a need for increased entries due to the potential for skips and gaps when spot treating (Desser 2008). This reduces the overall effectiveness ranking for alternative D to 66 percent meaning that about one-third of the acreage would have to be retreated each year until target populations reach a maintenance level and can be restored.

The most ambitious treatment scenario would treat all 2,124 acres within a year of this decision being signed (2014-2015 or year 1). The following year 34 percent of this acreage would still need to be treated and would be subject to annual spread. Table 22 shows how this would compound over time and increase the life of the project cost and average cost per acre. Restoration costs are the same across the action alternatives. Cooperative treatments between neighboring land owners and agencies involved with

invasive plant management would increase the effectiveness of alternative D to ensure weed spread between land ownerships is properly abated.

Table 22 below shows the costs per year, total cost over a 5-year period, and average cost per acre to be applied to unpredictable new infestations that could be discovered and treated over the life of the project according to common control measures, pdfs and subject to treatment caps associated with alternative D.

Table 22. Most ambitious treatment scenario and costs for alternative D

	Acres Treated	Acres Remaining to Be Treated	Add 10% spread rate	Cost Year 1
Year 1	2124	701	771	$424,800
Year 2	771	254	279	$154,200
Year 3	279	92	101	$55,800
Year 4	101	34	37	$20,200
Year 5 - restoration	1,231	Maintenance level	NA	$615,500
Total				**$1,270,500**
Average Cost per Acre with all activities included				$598
Applied to 30,000 acre life of the Project Cap For EDRR				Maximum of $15,930,000 over a fifteen year period

Alternative Comparison

Table 23. Results of the cost-effectiveness analysis for alternatives

Issue Indicator	Alternative A	Alternative B	Alternative C	Alternative D
Average Cost per Acre of Fully Effective Treatment (includes 4-6 years of re-treatments and restoration)	0	$544	$722	$598
Total Cost of Most Ambitious Treatment Scenario	0	$1,154,000	$1,472,900	$1,270,500
Maximum Cost over the Life of the Project (assuming maximum treatment caps multiplied by average per acre cost)	0	$16,320,000	$21,660,000	$17,940,000
Number of Years to Achieve Objectives (most ambitious treatment scenario)	More than 10-15 years	4 years	6 years	5 years

The Life of the Project

It is unlikely that the Malheur National Forest will be funded to implement the most ambitious treatment scenarios analyzed. Only a portion of the 2,124 acres currently needing treatment will likely be treated in year 1 regardless of action alternative selected. The economic analysis allows a consistent basis to see the impact of differences in alternatives and provides an estimate of the cost of fully treating and restoring an

acre, based on the metrics of existing infestations. The 30,000-acre cap is based on all existing infestations spreading over a 15-year period at a rate of 10 percent per year, without any reduction in acreage from treatment. The sooner treatment of existing infestations occurs; the less likely large numbers of acres will need to be treated in the future. The most ambitious conceivable scenarios described above demonstrate that the purpose and need for this project could be met in a compressed time frame, if funding and workforce were available.

Funding and workforce capacity will dictate how many acres are treated under the auspices of this project. The more acres that get treated immediately, the less cost and better effectiveness over time. However, it is more likely that the project will take 10 to 15 years to reach the maintenance level modeled in a compressed timeframe above.

3.1.5 Introduction to the Cumulative Effects Analysis

Introduction

Cumulative effects are the result of incremental impacts of the proposed actions/alternatives when added to other past, present, and reasonably foreseeable actions, both on National Forest System lands and adjacent federal, state, or private lands (40 CFR 1508.7). The baseline for cumulative effects analysis is the current condition as described in the affected environment sections throughout chapter 3.

Management activities and actions on neighboring lands contribute to spread or management of invasive plants on National Forest system lands, and vice versa. The effectiveness of the proposed invasive plants treatment project would be increased if coordination with adjacent landowners treats invasive infestation across land ownerships. The cumulative effects analysis assumes that this cooperative, coordinated effort will continue, and the release of biological control agents on lands adjacent lands by the Oregon Department of Agriculture, as analyzed by Animal Plant Health Inspection Service (APHIS), will continue, regardless of alternative.

Herbicides are commonly applied on lands other than National Forest System lands for a variety of agricultural, landscaping and invasive plant management purposes. Herbicide use occurs on tribal lands, state and county lands, private forestry lands, rangelands, utility corridors, road rights-of-way, and private property. No requirement or central reporting system exists to compile invasive plant management information on or off national forests in Oregon. Accurate accounting of the total acreage of invasive plant treatment for all land ownerships is unavailable. The estimates provided in this section are not precise and are uncertain given the long project life.

All invasive plant treatment methods have the potential to damage individual non-target plants, including sensitive species. Noise and worker activity can disturb wildlife and removal of vegetation can affect their habitat. If manual, mechanical or herbicide treatments create bare soil, erosion can be accelerated. Small amounts of herbicide or sediment could reach surface water and impact water quality or aquatic organisms. All treatments have the potential to injure a worker or result in other accidents; and all treatments would create jobs and cost money. There is little disagreement that the potential adverse impacts of non-herbicide invasive plant treatments are minor, small scale, and of short duration. The potential for non-herbicide treatments to result in effects of concern to the public is very low. The potential for cumulative effects from such treatments were discussed in the R6 2005 FEIS (chapter 4-39, 4-50, 4-61 to 62, 4-89 to 4-90, and 4-122 to 123) and are incorporated by reference.

The issues for this project center on the effects of herbicide use or restrictions of herbicide use in the alternatives. Some people have expressed concern that herbicide use from this project could combine with herbicide use elsewhere and have an additive, synergistic, or other cumulative effect; specifically the effects on wildlife, fish or people exposed to repeated doses of herbicides. The focus of the following

section is on herbicide use, however potential cumulative effects of non-herbicide treatment methods and other projects and land uses across and adjacent to the Malheur National Forest are discussed throughout chapter 3.

The relative scale of this project is so small that it is unlikely to contribute to measurable, detectable herbicide concentrations in downstream waters. Multiple herbicide exposures are unlikely to occur in close enough proximity in time or space with other applications to trigger cumulative effects. The small, scattered nature of the infestations, the relatively low toxicity and potential to cause adverse effects associated with the herbicides proposed for use, the pdfs, herbicide-use buffers and treatment caps that limit the extent, intensity and duration of potential adverse effects, and treating invasive plants cooperatively across administrative boundaries, all serve to minimize the potential for adverse effects to accumulate and amount to a measurable impact on people or the environment.

Counties are responsible for controlling noxious weeds along county roads and other county property outside of and within the Malheur National Forest. They also work with conservation districts, weed management areas, and watershed councils to control noxious weeds on private property. Additive herbicide exposures are possible if herbicide is used on neighboring lands during the same day as planned on the Forest. Treatments occurring on National Forest System land, lands of other federal agencies, states, and counties would be coordinated so treatment overlaps are unlikely. Any molecules of herbicide that leave a treatment site will have time to dilute and degrade before mixing with another contaminant. The R6 2005 FEIS (p. 4-10) estimated 3 percent of the herbicide use within Oregon and Washington is on National Forest System land.

The Bureau of Land Management has proposed invasive plant treatments using herbicides on BLM lands in Oregon; however their proposals are not site-specific enough to model cumulative effects at the watershed scale. The BLM contribution to cumulative effects would also be relatively low compared to other herbicide use in Oregon (USDI Bureau of Land Management 2010).

Herbicides are commonly applied for a variety of agricultural, landscaping and invasive plant management purposes. Herbicide use occurs on tribal lands, state and county lands, private forestry lands, rangelands, utility corridors, road rights-of-way, and private property. Studies (listed in this section) have shown that pesticides are commonly found in surface waters in Oregon and throughout the United States. However, the studies indicate that herbicide use similar to the type proposed in this project will not result in harmful concentrations of herbicide in water.

The R6 2005 FEIS (pages 4-1 to 4-3) and SERA Risk Assessments discussed effects of chronic exposure to low levels of herbicides used to treat invasive plants on National Forest System land. Chronic exposures do not result in cumulative effects because the herbicides are more rapidly excreted from organisms (people, animals and fish) than would be absorbed from predicted levels of exposure. Thus, an animal could encounter herbicide in more than one location over time; however there would be no possibility for this project to result in exposures that could cause a cumulative effect.

Statewide Herbicide Use

In 2007, approximately 284,984 reports of pesticide use were reported in Oregon. The top five active ingredients, by pounds, for the entire state were:

- Metam-sodium (42%) [soil fumigant]
- Glyphosate (9%) [herbicide]
- Copper naphthenate (7%) [wood preservative]
- 1,3-dichloropropene (5%) [soil fumigant]

- Aliphatic petroleum hydrocarbons (4%) [insecticide]

Of these, glyphosate is the only herbicide. It was the second most-used active ingredient and accounted for 9 percent of all pesticide use reported statewide. The vast majority was agricultural use. Statewide reported glyphosate use was over 3.5 million pounds. In the John Day Basins alone nearly 153,000 pounds of glyphosate were reportedly applied. Glyphosate is quickly taken up by plants or bound up with soils so that it is not mobile in the environment soon after application. Effects of glyphosate from invasive plant treatments are very limited in time and space to the immediate area of the treatment. If vegetation adjacent to or emergent from flowing water is treated, glyphosate may be detected downstream from the treatment. However, it is very likely bound to organic matter and not biologically active and very unlikely to cause any effect. Therefore, glyphosate use from other lands in the water basins is not likely to cause cumulative effects when added to the direct and indirect effects of this project. Many of the proposed herbicides have limited mobility in the environment so effects would be limited to areas immediately adjacent to the treatment sites; others, though mobile to some extent, have properties that bind them to soil particles or ensure rapid degradation, so do not pose a level of concern. Most of the herbicides proposed for use would not persist in the environment for more than a few weeks or months, and those that remain longer have pdfs limiting the frequency of use so that effects do not accumulate at the treatment site.

Three other herbicides proposed for use in the action alternatives are within the top 100 reported statewide in 2007: imazapyr, sulfometuron methyl, and triclopyr. None of these are first-choice herbicides in any alternative.

We are proposing a very low level of herbicide use compared to river basin or statewide use. The Forest Service contribution to cumulative herbicide use would remain low in all alternatives. No water quality issues related to pesticides have been identified in the waters in the project area (none of the streams in the area are 303d listed for chemical contamination).

Any herbicide reaching the stream would be quickly diluted and as the herbicide moved downstream it would become less and less likely to cause impacts. For instance, one of the relatively most mobile, persistent and toxic herbicides proposed for use in two alternatives, picloram, would become diluted by 85 to 98 percent by the time it moves 100 meters (328 feet) away from the application site (Evens and Duseja 1973). Glyphosate would be diluted sufficiently to stop affecting plants about 100 feet from the application site (Thistle 2007).

NWQAP Pesticide Study

Since 1991, the National Water Quality Assessment Program (NWQAP) has implemented interdisciplinary assessments in 51 of the Nation’s most important river basins and aquifers, referred to as Study Units, and the High Plains Regional Ground Water Study. The USGS published a report: “Pesticides in the Nation’s Streams and Ground Water, 1992–2001” (Gillom and others 2006) that presented evaluations of pesticides in streams and ground water based on findings for the first decadal cycle of NAWQA. The study found that undeveloped streams had one or more detectable pesticides or degrades 65 percent of the time. The study stated that presence of pesticide compounds in predominantly undeveloped watersheds may result from past or present uses within the watershed for purposes such as forest management or maintenance of rights-of-way, uses associated with small areas of urban or agricultural land, or atmospheric transport from other areas. None of the herbicides proposed for use in this project were detected in the national samples (however it is acknowledged that glyphosate is widely used but was omitted from the study).

The report discusses the many delivery mechanisms of pesticides to surface and ground water:

> *Pesticides are transported to streams and ground water primarily by runoff and recharge. Nonpoint sources of pesticides originating from areas where they were applied—rather than point sources such as wastewater discharges—are the most widespread causes of pesticide occurrence in streams and ground water (Modified from Majewski and Capel 1995.) The atmosphere is often overlooked as a source of pesticides, which return to earth with precipitation and dry deposition and can reach streams and ground water. Streams are particularly vulnerable to pesticide contamination because runoff from agricultural and urban areas flows directly into streams along with both dissolved and particle-associated pesticides. Ground water is most susceptible to contamination in areas where soils and the underlying unsaturated zone are most permeable and drainage practices do not divert recharge to surface waters.*

The study also stated:

> *Pesticide occurrence in streams and ground water does not necessarily cause adverse effects on aquatic ecosystems or humans. The potential for effects can be assessed by comparing measured pesticide concentrations with water-quality benchmarks, which are based on the concentrations at which effects may occur. No streams draining undeveloped land, and only one stream in a watershed with mixed land uses, had an annual mean concentration greater than a human-health benchmark.*

This study supports the conclusion that this project, combined with other herbicide use on lands of other ownership, would not result in herbicide delivery to streams over a threshold of concern for people or the environment. The State of California also conducted monitoring on surface water where 40,631 pounds of active ingredient of 13 herbicides and 19 insecticides were applied within the privately-owned watersheds upstream of sampled locations. No detectable concentrations of any herbicides were identified (reliable detection limits ranged from 0.04 to 2.0 ppb). The analysis included glyphosate and triclopyr. The results could have been affected by several months passing between dry weather application and the first rain, potentially allowing chemical degradation or adsorption to soil; or dilution of stream flow between application and monitoring sites may have contributed to the lack of positive detections (Jones et al. 2000).

Clackamas River Pesticide Study

Closer to home, a study about the background levels of pesticides in surface waters was done on the Clackamas River, part of the Willamette River Basin in western Oregon. The Pesticide occurrence and distribution in the lower Clackamas River basin, Oregon, 2000–2005 (Carpenter et al. 2008) was done as part of the NWQAP.

The Clackamas study took place from 2000–2005. Within 119 water samples from the Clackamas and its tributaries, 63 pesticide compounds: 33 herbicides, 15 insecticides, 6 fungicides, and 9 pesticides degradates were detected. Fifty-seven pesticides or degradates were detected in the tributaries (mostly during storms), whereas fewer compounds (26) were detected in samples of source water from the lower Mainstem Clackamas River, with fewest (15) occurring in drinking water.

The study stated that the two most commonly detected pesticides were the triazine herbicides simazine and atrazine, which occurred in about one-half of samples. It also said that the active ingredients in the “common household herbicides” RoundUp™ (glyphosate) and Crossbow™ (triclopyr and 2,4-D) also were frequently detected together. These three herbicides often made up most of the total pesticide concentration in tributaries throughout the study area.

The study stated that pesticides were most prevalent in the Clackamas River during storms, and were present in all storm-runoff samples — averaging 10 individual pesticides per sample from these streams. Two tributaries contained 17–18 different pesticides each during a storm in May 2005. These medium-

sized streams drain a mix of agricultural land (row crops and nurseries), pastureland, and rural residential areas. Two small streams that drain the highly urban and industrial northwestern part of the lower basin had the greatest pesticide loads. Streams draining predominantly forested basins contained fewer pesticide detections (2–5 pesticides). The study stated that pesticide use on the Mount Hood National Forest, which comprises most of the Federal land in the upper Clackamas River Basin, was a relatively insignificant contribution.

Invasive Plant Spread and Cumulative Effects

Invasive plant target species on the Malheur National Forest are predominantly annual and perennial forb species. Scotch broom, an invasive woody shrub, has limited occurrence in this dry habitat, preferring higher moisture and cool conditions on the western Cascade forests. Most of the forbs that are invasive on the Malheur National Forest have a tap root that mines a greater depth of soil to acquire water and nutrients (Kulmatiski et al. 2008). Annual plants such as the annual grasses do not penetrate deep into soil, but grow quickly during ample moisture and when nutrient levels are high (Eviner and Firestone 2007). Thus, these plants have high propensity to grow on disturbed areas where water-holding capacity and organic matter levels are low for most of the year except during the short nutrient-burst periods when moisture and cold temperatures are not limiting.

The majority of the invasive plants on the Malheur National Forest have strong affinity to open light conditions and low shade tolerance. Thus, a strong correlation exists for invasive plants in recently deforested areas, road corridor openings and open rangelands. The low shade tolerance of most the weed species found on the Malheur National Forest is evident in studies from the Rocky Mountains and eastern Washington. Studies of edge environments found substantial drops in weeds moving away from major roadways in shaded environments (Hansen and Clevenger 2005, Pauchard and Alaback 2006, Buonopane et al. 2013). The central Washington study found that invasive plants, many common to the Malheur NF, on average did not penetrate further than 32 feet from the roadside where a forest canopy existed (Buonopane et al. 2013). Similarly, a Canadian study in eastern front Rocky Mountains observed substantial decrease in invasive plants 32 feet from a roadway in a forested environment as compared to about 490 feet in a rangeland environment. Field observations in the Malheur National Forest had a similar trend.

Disturbances that can be subject to weed invasion vary in frequency and intensity (James et al. 2010). A forest fire that burns at high and moderate severity can completely eliminate the overstory and understory plant canopy and bare soil. The combusted organic material leaves a high nutrient load. Though the disturbance has high intensity, the spike in nutrient load and amount of exposed bare soil decreases rapidly within 5 years as the native vegetation recolonizes the site and the risk of weed invasion declines. In contrast, livestock grazing occurs every season. The scale of the disturbance can be much less intense than a damaging wildfire since grazing exposes a fraction of soil area compared to wildfire; however, the intensity of the grazing increases if cattle are concentrated in specific areas.

Ground disturbance associated with natural processes such as wildland fire, and human activities, such as road use, may favor the spread of invasive plants and discourage the reestablishment of native species. Seastedt et al. 2008, notes that human-caused disturbance can change soil conditions to which native species have adapted, which further results in conditions that favor invasive plants. Repeated road clearing and graveling, an open gravel pit, or a cleared compacted recreation area create environments that favor colonists species or vegetation that can optimize a large volume of soil with a taproot or species which germinate quickly, grow and set seed during the limited growing conditions of the site. Roadside environments have coarser texture growing substrate with higher rock content and thus represent growing environments that favor invasive plants (Gelbard and Belnap 2003).Generally; disturbed environments have greater available resources for invasive plants because of exposed soil, open light, and higher

nutrient and water availability. Shade under forest canopies substantially limits weed growth. Most of the primary target species on the Forest do not invade shaded environments.

The relationship between OHV trail use, travel access management, and the introduction, establishment and spread of invasive plants was discussed in the R6 2005 FEIS. Off-highway vehicle use can influence the spread of invasive plants by disturbing soil and carrying seed several orders of magnitude greater than 'conventional' dispersal methods (R6 2005 FEIS p. 3-15). Vehicle traffic is considered the major vector for weed seeds since long stretches of roadways have invasive plants; vehicles cover large distances and can pick-up and deposit seeds into new areas (Trombulak and Frissell 2000, Zouhar 2008, Flory and Clay 2009, Birdsall et al. 2011).

Invasive plant density drops in shaded environments (Hansen and Clevenger 2005, Pauchard and Alaback 2006, Buonopane et al. 2013). Buonopane et al. (2013) found high rates of noxious weed seeds in the topsoil and litter layer well within the Malheur National Forest adjacent to infested roadsides. This indicates that invasive plants would be readily introduced to nearby disturbed areas even if no invasive plants are visible under the existing forest canopy. Roads and rights-of-way have the highest incidence of invasive plants due to perpetual disturbance together with a constant seed source from passing traffic (Zouhar 2008, Birsall et al. 2011). The open light conditions inherent to roads creates ideal habitat since most invasive plants on the Forest do not tolerate shade. The road disturbance footprint has gravelly road fill emplaced next to dugout ditches, and bared cutslopes, open sites for invasive plants to establish. Roadways and railways fragment the landscape, creating edge environments where invasive plants can thrive (Hansen and Clevenger 2005).

Roads and traffic are primary vectors for invasive plant spread. Invasive plants are found where vehicle traffic congregates; recreation areas, parking lots and where forest management activities concentrate at log landings. Road maintenance activities can also spread invasive plants from mowing and grading activities. Transplanted road materials from infested rock pits may carry weed seeds and plant parts into more remote locations of the Forest. Measures such as using weed-free products and timing road maintenance to avoid spreading invasive plants can help prevent invasive plant spread.

Roads vary for risk of invasive plants depending on the level of construction. A four-wheel-drive two-track vehicle has much less potential for sustaining invasive plants compared to a high-level constructed highway. The construction footprint extends from the roadside to the edge where the natural vegetation dominates. Typically, the edge of the roadcut demarcates the change when roads cross forests. Gelbard and Belnap (2003) documented an average 50-foot novel vegetation width along paved roadways compared to a 6-foot width along four-wheel-drive two tracks. The large unique vegetation span along the paved road coincided with the placement of fill and excavation. When comparing level of exotic plants, the researchers found a four time increase in cheatgrass along the paved roads versus the two-track road. A paved road also sheds water more effectively than low bermed primitive roads, creating high water and nutrient availability for exotic plant growth. Other authors report changes away from weedy roadside vegetation at an average 98 feet in Illinois (Flory and Clay 2009) and 32 feet in east slope Washington (Buonopane et al. 2013) for forests along major roadways.

Streams have annual disturbance from fluctuating streamflow. Snowmelt flush bares stream edges leaving gravel bars and silt that is primary succession habitat. Invasive plants can easily occupy these sites, but the mesic conditions and well-adapted riparian vegetation readily compete to re-occupy these sites. The riparian vegetation forms a type of biotic resistance that damps the spread of invasive plants. The seed dispersal of invasive plants is periodic, and dispersed by streamwater, birds, and animals along the riparian corridor.

Grazing lands experience annual disturbance from livestock along with intermittent vehicle use that can bare soils in livestock congregation areas near troughs, salt licks, fences and water ways. Plant parts may

stick to animals and be transported into rangelands. The grazing activities on the Forest result in overall moderate level of disturbance and occur within a timeframe of less than 6 months per year. The moderate level corresponds to the small and distributed amount of disturbance across the allotment.

Vegetation clearing from fuels and logging activities disturbs soils from log yarding. Temporary transportation routes result in severe disturbance but lack annual traffic. The initial soil mixing from logging activities can lead to short-term increases in nutrient release (Booth et al. 2004). The available nutrients on these disturbed skid trails and lack of competing plants create ripe conditions for noxious invasive plants to spread. The sites remain open to infestation while native understory and overstory vegetation re-occupy the site in the initial period after logging for 1 to 3 years. However, the propagule pressure from vehicle traffic is limited to the logging activity.

Burned areas have conditions that favor invasive plant spread by eliminating competing plants and bolstering the nutrient availability (Zouhar 2008, James et al 2010). The initial nutrient flush is a result of the thermal decomposition of burned vegetation combined with the subsequent further decomposition and release of nutrients by soil organisms (Hart et al. 2005). These conditions create extremely high invasion potential a few years following fire, but risk decreases over time as native vegetation recolonizes and nutrient levels drop (Zouhar 2008). Places of high heat from heavy fuels burning may favor invasion by Canada thistle and bull thistle. During field surveys of the Malheur National Forest invasive plant sites, Canada thistle was found to colonize old burned pile scars; the thistle has high tolerance for the alkaline and poor soil conditions associated with these severely burned areas (Korb et al. 2004, Meyer 2009).

In burned areas, the risk for weed infestation decreases with time much like after timber harvest. The initial disturbance has much traffic from fire suppression followed by rehabilitation and possible salvage activities; although wildfire typically results in a much higher intensity disturbance than timber harvest from complete combustion of forest and shrublands during very dry hot conditions.

Prescribed fire results in low intensity burning that retains vegetation generally across 85 percent of the forest floor and leaves less than 15 percent soil cover. These are default values used in the Forest Service Water Erosion Prediction Project's Disturbed WEPP application. Increased nutrient pulses result from 1 to 2 years (Hart et al. 2005) but fewer disturbances create an overall low risk for invasion.

The various sections of chapter 3 address cumulative effects arising from treatment of invasive plant over the next 5 to 15 years. We will likely have a need for continued applications of herbicides and other integrated treatments throughout the life of the project. Chapter 3 discusses how the use of herbicides through the life of the project could further affect National Forest System lands on the Forest that are being impacted by ground disturbance.

Table 24 displays potential disturbance frequency and intensity, and invasive plant propagule pressure associated with ongoing activities that are vectors for invasive plant spread. Disturbance frequency and intensity and propagule pressure strongly factors influence the rate that invasive plants are likely to spread along vectors. The most applicable R6 2005 ROD Standard dealing with preventing the spread of invasive plants via each vector is also shown. Prevention is an important aspect of our invasive plant management program. National policies and regional and local plans are in place to reduce the potential for invasive plants to become introduced, established or to spread as a result of our activities. See chapter 3.1.4, Treatment Effectiveness, for more information about how the location of infestations and surrounding vectors influence our treatment and restoration methods.

Table 24. Potential disturbance frequency for invasive plants spread

Vector	Disturbance Frequency/ Potential Maximum Intensity	Potential Propagule Pressure	Most Applicable R6 Management Direction/ Prevention Considerations
Recreation sites management, dispersed and developed sites; campgrounds, hunter camps, trailheads.	Perpetual/Low	High	R6 Goal 1, Objectives 1.2; 2.4, 2.5; Standards 1, 4; outreach and education, travel management, recreation management
Livestock grazing; Dry open grassland steppe, shrub lands, dry forestlands	Seasonal/Moderate to High	Moderate to High	R6 Goals 1, 2; Objectives 1.2, 2.1, 2.2; Objective 5.3; Standards 4,6; AMPs and annual operating plans,
Vegetation management (thinning and brushing, logging, burning)	Periodic/High (especially yarding corridors and landings, pile burning)	High	R6 Goals 1,2; Objectives 1.1, 2.1, 2.2, Standards 1, 2, 3, 13 Strategy to prevent Canada thistle
Wildland fire and incident response	Periodic/Low to High	Moderate	R6 Goals 1, 2; Objectives 1.1, 1.3, 1.5 2.3; Standards 1, 2*, 3, 13 *although emergency situations like wildland fire are explicitly exempt from this equipment cleaning standard, Forests report that it happens routinely.
Roads (road maintenance, construction, reconstruction and use)	Perpetual/High	High	R6 Goals 1,2; Objectives 1.1, 2.4, 2.5; Standards 1, 2, 7, 8, 13 Forests report excellent coordination with engineering staff , quarries are inspected and road materials are weed free
Closing roads	Periodic/Low	Moderate	R6 Goal 2; Objective 2.4; Standards 1, 2, 3, 13
Restoring roads and landings	One time/ Low to High	Moderate	R6 Goals 1, 2; Objective 1.1; 2.1, 2.4; Standards 1, 2, 3, 13
Adjacent agriculture	Perpetual/Low	Low	R6 Goal 5; objectives 5.1-5.3
Stream restoration (i.e., fish passage and habitat projects, riparian vegetation restoration), Stream flow	Seasonal/High	Low	R6 Goals 1, 2; Objectives 1.1, 1.3, 1.5, 2.1, 2.2; standards 1, 2, Keep equipment working near streams clean.

Reasonably Foreseeable Projects on the Malheur National Forest

The Forest Service is proposing a variety of activities throughout the planning area, below is a listing of projects that foreseeably could overlap in time and space with invasive plant treatments. Additional ongoing projects may overlap with invasive plant treatment (for instance road, trail and administrative site maintenance; and vegetation and habitat management and restoration).

The cumulative effects analysis addresses at the potential for the lingering impacts of invasive plant treatments to overlap in time and space with the effects of a particular project and cause additive, synergistic or other impacts. The cumulative effects analysis also considers the ongoing activities described in the previous table.

Table 25. Foreseeable future projects on the Forest with project details, vectors for invasive plant spread, watershed(s) affected and implementation schedule

Project name	Project Details	Potential Vector	Watershed(s)	Implementation Schedule
Bald Butte LO Decommission	Remove Lookout with explosives	Recreation Site management	Middle Silver Creek	2013
Bear Creek Riparian Juniper Thinning	Thin 47 acres of juniper	Vegetation Management	Upper South Fork John Day River	2014
Blue Mountain Snow Park	Clearing trees and leveling 7 acres and paving parking area; construction of warming hut, restrooms, and grooming shed; construction of pad for fuel tank	Recreation Site management	Summit Creek (170702030102)	2013
Buck and Rock Springs Campground Hazard Tree Removal Project	Remove hazard trees	Recreation Site management	Upper Silver Creek and Wolf Creek	2013
Camp Creek LWD	Felling and placing entire trees ranging from 4- 20 inches in diameter within the following streams and their associated Riparian Habitat Conservation Areas (RHCAs)	Stream Restoration	Upper Camp Creek (170702030205); Lick Creek (170702030205)	2013-14
Campground Hazard Tree Project	Remove hazard trees in D-Lake, Idlewild, Joaquin Miller, Yellowjacket, Emigrant Creek, Falls Camp	Vegetation Management	Upper Silver, Upper Silvies, North Basin, Emigrant Creek	2013
Dairy EA	Commercial harvest, road closures and decommissioning	Vegetation Management	Upper Silver Creek	2013-2014 road closures may go on for years
Damon	RX fire, commercial and non-commercial harvest, road closures and decommissioning	Vegetation Management, Closing Roads, Restoring Roads and Landings	Van Aspen-Silvies River (171200020105); Lower Scotty Creek (171200020104); Shirtail Creek (171200020301)	FY 11 to FY 13
Dragon's Head Plantation PCT	thin plantations	Vegetation Management - Ground disturbance, open canopy	Wolf Creek and Upper Silvies River	2013 and beyond

Project name	Project Details	Potential Vector	Watershed(s)	Implementation Schedule
Dragon's Hump Plantation PCT	PCT and treat slash on 5000 acres of plantations	Vegetation Management	Middle Silvies and Emigrant Creek	2013 and beyond
Egley Aspen Restoration Project	thin and remove conifers up to 20.9 inches in 20 acres of aspen	Vegetation Management	Emigrant Creek	2013
Egley/Pine Springs Overlook Interpretive Display Update and Toilet Replacement project	replace toilet	Recreation Site management	Middle Silver Creek	unknown, no funding, low priority
Elk 16	RX fire, commercial and non-commercial harvest, road closures and decommissioning, aspen restoration, aquatic restoration	Vegetation Management, Closing Roads, Restoring Roads and Landings, Stream Restoration	Elk Creek and Crane Creek Subwatershed	FY 2015
Galena Project	RX fire, commercial and non-commercial harvest, road closures and decommissioning	Vegetation Management, Closing Roads, Restoring Roads and Landings	Vinegar Creek-MFJDR (170702030201); Little Boulder Creek-MFJDR (170702030202)	FY 14 to FY 17
Green Ant Project (Formerly the Ant and Emigrant Projects)	Commercial harvest, road closures and decommissioning	Vegetation Management	Emigrant Creek	2013 and beyond
Idlewild Snowpark Relocation Project	Relocate snowpark	Recreation Site management	North Basin	2013
Jane Hazardous Fuel Reduction Project	RX fire, commercial and non- commercial harvest, road closures and decommissioning	Vegetation Management, Closing Roads, Restoring Roads and Landings	Wolf Creek	2013 and beyond
JB Spring Development and Trough	Develop spring, thin 5 acres of juniper	Livestock Grazing, Vegetation Management	Griffin Creek/Upper Malheur River	2013
Keeney Meadows Aspen	Non-commercial thinning and fencing 10 aspen stands	Vegetation Management	Bridge Creek (170702030105); Headwaters Long Creek (170702030401); East Fork Beech Creek (170702010802); Upper Camp Creek (170702030205); Headwaters Long Creek (170702030401);	July - Aug 2014
Logan Valley Grazing Authorization	Grazing authorization on the Summit Prairie, Logan Valley, McCoy Creek, and Lake Creek Grazing Allotment	Livestock Grazing	Lake Creek, Bosenberg Creek, Upper Big Creek, Summit Creek Subwatershed	FY 2014

Project name	Project Details	Potential Vector	Watershed(s)	Implementation Schedule
Malheur River Range Aquatics Projects	Extension of the Malheur River Drift Fence. Cross Springs water source reconstruction and extension to a second trough. Development of Dollar Basin Spring	Livestock Grazing	Lake Creek and Bosenberg Creek Subwatershed	FY 2013
Marshall/Devine Hazardous Fuel Reduction Project	RX fire, commercial and non-commercial harvest, road closures and decommissioning	Vegetation Management, Closing Roads, Restoring Roads and Landings	Upper Silvies River and North Basin	2013-2014 road closures may go on for years
Murderer's Creek Juniper Management Project	Cutting of juniper and mixed conifer, fuel treatment, aspen restoration, and watershed improvement activities.	Vegetation Management; Stream Restoration	Deardorff Creek (170702010502); Corner Creek-South Fork John Day River (170702010402); Lower Murderers Creek (170702010305); Lower Deer Creek (170702010206)	FY 2014
Plantation Maintenance Fox/Camp Creek	Non-commercial thinning of plantations	Vegetation Management	Dixie Meadows (170702010602); Bear Creek (17070201603); Grub Creek (170702010607); Upper Beech Creek (170702010801); East Fork Beech Creek (170702010802); Lower Beech Creek (170702010803); Birch Creek (170702010905); Dry Creek-John Day River (170702010906); Belshaw Creek (170702011003); Cummings Creek (170702011005); Wiley Creek (170702020902); McHaley Creek (170702020903); Lower Fox Creek (170702020904); Upper Cottonwood Creek (170702020905); Upper Camp Creek (170702030205); Lick Creek (170702030206); Lower Camp Creek (170702030207)	FY 13 to FY 23

Project name	Project Details	Potential Vector	Watershed(s)	Implementation Schedule
Plantation Maintenance Long Creek	Non-commercial thinning of plantations	Vegetation Management	Indian Creek-MFJDR (170702030303); Slide Creek (170702030304); Granite Creek-MFJDR (170702030305); Headwaters Long Creek (170702030401); Upper Long Creek (170702030402); Basin Creek (170702030404); Basin Creek (170702030406); Upper Deer Creek (170702021001); Upper Fox Creek (170702020901); McHaley Creek (170702020903)	FY 12 to FY 22
Sawtooth and Emigrant Creek Culvert Replacement	replace culverts	Stream restoration	Emigrant Creek	Sawtooth complete, Emigrant creek not, no funding, low priority
Sawtooth and Nicoll Checkdam Modification	modify existing structures	Stream restoration	Emigrant Creek and Upper Silver Creek	unknown, no funding, low priority
Schurtz Creek Story-Fry Riparian Restoration Project	Fence and thin conifers less than 21 inches	Vegetation Management	Wolf Creek	2013-2014
Season of Burn Research Project	Rx burn research units	Vegetation Management	Pine Creek and Upper Silvies River	2013 and beyond
SF John Day Culverts Replacements	Replace 3 culverts	Stream Restoration	Upper South Fork John Day River	2013 and beyond
Soda Bear	RX fire, commercial and non-commercial harvest, road closures and decommissioning	Vegetation Management, Closing Roads, Restoring Roads and Landings	Middle Bear Creek (171200020202); Lower Bear Creek (171200020204)	FY 13 to FY 15
South Fork John Day Riparian Juniper Thinning	thin 90 acres of juniper	Vegetation Management	Upper South Fork John Day River	unknown, no funding, low priority
Starr Aspen	Commercial and Non-commercial thinning, Rx fire, fencing, wood in streams, road closures	Vegetation Management, Closing Roads, Restoring Roads and Landings, Stream Restoration	Starr Creek-Silvies River (171200020102)	FY 15

Project name	Project Details	Potential Vector	Watershed(s)	Implementation Schedule
Starr HFRA	RX fire, commercial and non-commercial harvest, road closures	Vegetation Management, Closing Roads, Restoring Roads and Landings	Starr Creek-Silvies River (171200020102)	FY 12 to FY 15
Summit	RX fire, commercial and non-commercial harvest, road closures and decommissioning, aspen restoration, aquatic restoration	Vegetation Management, Closing Roads, Restoring Roads and Landings, Stream Restoration	Summit Creek and Tureman Creek Subwatersheds	FY 2016
Thompson Butte SUP Passive Reflector Removal	remove reflector	Recreation Site management	Pine Creek	2013
UMF Culvert Replacement	Replacement of 15 culverts located on twelve tributaries in two watersheds of the Middle Fork John Day River subbasin.	Stream Restoration	Summit Creek (170702030102); Bridge Creek (170702030105); Vinegar Creek-MFJDR (170702030205); Little Boulder Creek-MFJDR (170702030202); Granite Boulder-MFJDR (170702030203); Balance Creek (170702030208)	July - Aug 2014
Upper Pine Hazardous fuel Reduction Project	RX fire, commercial and non-commercial harvest, road closures and decommissioning	Vegetation Management, Closing Roads, Restoring Roads and Landings	Pine Creek	2014-2015 road closures may go on for years
Voigt Ditch Headgate Replacement	Replacing current head gate with a new one including a measuring device and extending pipe down existing easement.	Adjacent Agriculture	Mill Creek (170702030106)	July - Aug 2013
Whistle Rx Burn	Rx Burn 3450 acres	Ground disturbance, open canopy	Upper Silver Creek	unknown, low priority

Under all action alternatives, some level of invasive plant control would occur on 2,124 acres, and of this, 1,067 acres occur within watersheds where some future management activity is anticipated. Watersheds that contain mapped invasive plants and future management activities are displayed in table 26. However, through the life of the project, newly detected infestations in any watershed could be treated according to the alternative selected.

Table 26. Watersheds containing planned future activities and invasive plant treatments

Watershed	Future Activity[1]	Invasive Plant Acreage[2]
Birch Creek	P	1
Bosenberg Creek	G	4
Bridge Creek	T, R,G	26
Crane Creek	T,B,	12
Deardorff Creek	T	11
Dry Cr. John Day River	P	<1
Elk Creek	T,B	24
Emigrant Creek	T,R	44
Granite Boulder Creek	R,P	120
Long Creek	P	1
Indian Creek	P	1
Lake Creek	G	3
Lick Creek	G	8
Little Boulder Creek	T,B,R	139
Long Creek	P	18
Lower Bear Creek	T,B	1
Lower Deer Creek	T,	1
Lower Scotty Creek	T,B	3
Middle Bear Creek	T,B	2
Middle Silvies River	R	6
Mill Creek	R	145
North Basin	T,B,F,R	15
Pine Creek	B,R,	79
Slide Creek	P	6
Starr Creek	T,F,B	16
Summit Creek	T,B,G	15
Upper Big Creek	G	5
Upper Camp Creek	G	14
Upper Deer Creek	P	1
Upper Fox Creek	P	22
Upper Long Creek	P	18
Upper Malheur River	P	45
Upper South Fork John Day River	T	46
Upper Silver Creek	T,B,R	20
Upper Silvies River	T,B,F,R,P	56
Van Aspen-Silvies River	T,B	15
Vinegar Creek	T,B,R	81
Wiley Creek	P,B,R	2
Wolf Creek	T	38
Total Acreage Invasive Plants		**1,067**

1 – Activity Codes (T)-Timber harvest, (B)-Burning, (F)-Fuel Reduction, (R)-Recreation/facility, (P)-Plantation thinning, (G)-Grazing improvements. 2 – Invasive plants that don't occur in watersheds with foreseeable future projects are not displayed.

3.2 Human Health

3.2.1 Introduction

This section summarizes information from the R6 2005 FEIS and accompanying Appendix Q: Human Health Risk Assessment, which detailed the potential for health effects from non-herbicide treatments as well as the use of 10 of the herbicides proposed for this project, and is incorporated by reference in this EIS. This section also discusses the proposal to add a new herbicide, aminopyralid, which has been shown to be more effective with less risk of adverse effects. The Aminopyralid Risk Assessment (SERA, 2007) conducted a scientific human health risk assessment and is the primary source of toxicological information about that herbicide. Pacific Northwest Region 6 Pesticide Use Coordination staff reviewed the information about aminopyralid and found that it poses low risk to human health and compares favorably to the herbicides approved in the R6 2005 ROD (see table 18, chapter 3.1.2 in this DEIS).

The R6 2005 ROD adopted standards to minimize herbicide exposures of concern to workers and the public based on the human health risk assessments. This analysis is tiered to the human health toxicity information in the R6 2005 FEIS. Herbicide active ingredients, metabolites, inert ingredients, and adjuvants, and people with particular herbicide sensitivity were addressed.

Hazards normally encountered while working in the woods (strains, sprains, falls) are possible during herbicide and non-herbicide invasive plant treatment operations. Such hazards are mitigated through worker compliance with occupational health and safety standards and are not a significant issue for this project-level analysis. Non-herbicide treatments are routinely implemented on the Malheur National Forest and no extraordinary circumstances have been found requiring the need for additional human health analysis for manual and mechanical type treatments. Although the action alternatives may rely on varying levels of non-herbicide treatments, the difference between the exposures to occupational hazards are negligible. For more information on potential effects of non-herbicide treatments, see the R6 2005 FEIS chapter 4.5.

Many people express concern about the effects of herbicides on human health, thus herbicide toxicity and their impact on people are significant public issues. Herbicide use has been studied comprehensively through the R6 2005 FEIS; the results of risk assessments indicate that herbicide exposures from projects that follow R6 2005 ROD standards are unlikely to harm anyone’s health. This conclusion is based on facts about chemistry of the herbicides considered for use and the mechanisms by which exposures of concern might occur. The following section summarizes these analyses to determine whether herbicide treatments proposed for the Forest would pose any unique risks not already addressed.

The use of herbicide in the action alternatives would be according to label requirements, with further direction in Malheur National Forest LRMP as amended by the R6 2005 ROD for standards and other management requirements associated with the project. Scientific herbicide risk assessments are updated on an ongoing basis, for instance the glyphosate risk assessment was updated in 2010 (SERA 2010).

Regulatory Framework and Compliance

The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) established the United States system of pesticide regulation to protect applicators, consumers and the environment. It is administered by the Environmental Protection Agency and the appropriate environmental agencies of the respective states. The Federal Insecticide, Fungicide, and Rodenticide Act 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 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.

In addition to label requirements and direction contained in FSM/FSH, the Forest LRMP as amended by the R6 2005 ROD, programmatically approves the use of certain herbicides and adopted standards to minimize herbicide exposures of concern to workers and the public. See table 1 in chapter 1.7 for a list of these standards and chapter 3.1.2 for risk assessment terminology.

All alternatives comply with standards, policies, and laws aimed at protecting worker safety and public health. This project would not result in disproportionate impacts to low income or minority group.

3.2.2 Affected Environment

The Malheur National Forest lies in a relatively remote part of Oregon, however people live near, spend time in, work in, or depend on forest products from the Malheur National Forest (Forest). Some dispersed and developed recreation areas (trailheads, campgrounds, picnic areas, recreation sites) and traditional gathering and special forest product collection areas currently occur in or near the vicinity of invasive plant sites (see chapters 3.3, 3.9 and 3.10 for more information). People engaged in forest activities could potentially be inadvertently exposed to herbicides from treatment of invasive plants in or near these areas. Hunting is by far the greatest use on the Forest (chapter 3.9).

A variety of mushrooms, berries, roots, and herbs, some of which have cultural importance to traditional gatherers, occur on the Forest. Cultural plants are used for food and baskets and traditional gathering is essential to the maintenance of tribal traditions and culture. Gathering is also economically important. Gatherers return to the accustomed gathering areas of their ancestors to tend and harvest plants to be used for traditional purposes. The Forest also issues permits for special forest products, such as firewood gathering. Firewood gatherers have a greater potential for contact with contaminated vegetation than the general public because cutting sites are in accessible, disturbed areas that might contain invasive plants. Special forest product collectors could have a greater potential for contact with contaminated vegetation than the general public.

Invasive plant infested sites are scattered throughout the Malheur National Forest and occupy less than 1 percent of National Forest System lands. Invasive plant treatments on the Forest are implemented through Forest Service contracts or in partnership with county operations. Applicators are generally from the communities in and around the Forest, and are licensed by the State of Oregon and well-trained in safe herbicide application and transportation practices. Licensed applicators are required to take regular training in order to maintain their license (ODA 2013).

The Malheur National Forest has several formal agreements for use of drinking water. The Hydrology section lists municipal watersheds, springs, and well intakes with formal agreements where known invasive plant populations exist.

3.2.3 Environmental Consequences

Worker Herbicide Exposure Analysis

The risk assessments include analysis for both workers and the general public. This section focuses on the risks of proposed herbicide application to applicators themselves. Herbicide applicators are more likely than the general public to be exposed to herbicides, and may handle undiluted herbicide concentrate during mixing and loading. In routine broadcast and spot applications, workers may contact and internalize herbicides mainly through exposed skin, but also through the eyes, mouth, nose or lungs. Worker exposure is influenced by the application rate selected for the herbicide, the number of hours worked per day, the acres treated per hour, and variability in human dermal absorption rates.

All herbicides can cause irritation and damage to the skin and eyes if mishandled. Eye or skin irritation would likely be the only overt effect because of mishandling these herbicides. These effects can be minimized or avoided by prudent industrial hygiene practices during handling. Worker exposure can be effectively managed through ordinary prudent practices, limiting the number of hours per day that workers are exposed to herbicide, and limiting the application rates and application methods for situations that may affect worker health. Herbicide labels indicate the personal protective equipment required for applicators.

Appendix Q-Human Health Risk Assessment, of the R6 2005 FEIS, and the 2007 aminopyralid risk assessment, summarizes risks for backpack and broadcast spraying at typical and maximum label rates, under normal application and maximum exposures. Four potential exposure levels were evaluated, ranging from predicted average exposure to unlikely maximum exposures. Risks from accidental/incidental exposures are also displayed. Backpack spray exposures assume that workers treat a little more than 4 acres per day and broadcast spray exposures assume that workers treat 112 acres per day. For both scenarios, it is assumed that the workers do not receive any protection from exposure provided by clothing

Accidental worker exposures are most likely to involve splashing a solution of herbicides into the eyes or on the skin. Two general types of exposure are modeled: one involving direct contact with a solution of the herbicide and another associated with accidental spills of the herbicide concentrate onto the surface of the skin. Exposure scenarios involving direct contact with herbicide solutions are characterized by immersing unprotected hands for 1 minute or wearing contaminated gloves for 1 hour. Workers are not likely to immerse their hands in herbicide; however, the contamination of gloves or other clothing is possible.

Exposure scenarios involving chemical spills onto the skin are characterized by a spill onto the lower legs as well as a spill onto the hands. In these scenarios, it is assumed that a solution of the chemical is spilled onto a given surface area of skin and that a certain amount of the chemical adheres to the skin.

The herbicides proposed for use under all alternatives have little potential to harm workers. In most cases, even when maximum rates and exposures were considered, hazard quotient (HQ) values were below the threshold of concern (HQ values ranged from 0.01 to 1). However, HQ values are greater than 1 for the herbicides chlorsulfuron, sulfometuron methyl, triclopyr and the surfactant called NPE for the following scenarios:

1. Broadcast application of chlorsulfuron at maximum rate/exposure
2. Backpack and broadcast application of sulfometuron methyl at maximum rate/exposure
3. Triclopyr

4. Backpack and broadcast application of NPE surfactant at maximum rate/exposure

Besides the unlikely maximum exposure scenarios described in the risk assessments, operational exposures would remain below the threshold of concern for all herbicides proposed for use except for triclopyr. The risk assessment found that a low risk of impaired kidney function is associated with operational triclopyr exposures. There are differences between the toxicity of the aquatic formulation (Garlon 3A®) and the terrestrial formulation (Garlon 4®). The aquatic formulation is less toxic.

Under a backpack (spot) application scenario, using the Garlon 4® formulation of triclopyr, workers could be exposed to herbicides at a level above the threshold of concern (HQ is greater than 1). Protective procedures to avoid the maximum potential exposure would be particularly important for workers who may apply triclopyr repeatedly at typical rates over a period of several weeks or longer. The HQ values are as high as 16 for the maximum backpack-applicator exposure scenario, however this type of exposure would be implausible because applicators are required to wear long pants, long sleeves, and gloves and comply with other personal safety practices and project design features. Accidental exposure to the Garlon 4® formulation of triclopyr can also have impacts that are more serious to the eyes. Triclopyr is not among the first-choice herbicide in any alternative.

The surfactant NPE is also associated with some human health risks at typical rates. For NPE, the HQ=5 for maximum plausible backpack applicator exposure scenario. The HQ = 10 for broadcast applications including NPE under a maximum exposure scenario. However, pdf F2 limits the amount of NPE that would be applied.

In addition, two herbicides, picloram and clopyralid, contain an industrial by-product of the manufacturing process that is linked to cancer: hexachlorobenzene (HCB). Picloram contains a higher concentration of HCB than does clopyralid. One alternative (D) would use picloram as the first-choice herbicide for about 63 acres. One operational exposure scenario resulted in HCB exposure above the cancer risk threshold: boom broadcast application of picloram at the maximum application rate, treating 112 acres in one day, and not wearing any protective clothing. Required personal protective equipment and pdfs (F group) would make it unlikely for any workers to actually receive the maximum exposure and thus, use of this herbicide would not result in measurable cancer risks to workers.

Public Herbicide Exposure Analysis

Under normal conditions, the general public would not be exposed to substantial levels of any herbicides used in the implementation of this project. Appendix Q of the R6 2005 FEIS and the aminopyralid risk assessment considered both plausible and highly unlikely accidental acute exposures, as well as long term chronic exposures to herbicide ingredients, and displays results assuming a human directly contacts herbicide, contacts sprayed vegetation, or consumes sprayed vegetation, contaminated water or fish. Few plausible scenarios exist that exceed even the most conservative threshold of concern for public health and safety. Below the threshold of concern (HQ less than or equal to 1), the risk is extremely low for any adverse effects due to the particular exposure scenario.

Direct Contact

There is virtually no chance of the public being directly sprayed given the broadcast, spot, and hand/select methods proposed in the action alternatives. A person could brush up against sprayed vegetation soon after herbicide is applied. Such contact is unlikely because spraying occurs during the work-week (not on weekends), and public exposure would be discouraged during and after herbicide application, through notification or signing.

For all herbicides, direct contact with sprayed vegetation would not exceed a level of concern. The risk assessments evaluated an accidental scenario where a small naked child is completely covered from a

direct herbicide spray. Even under this extreme and highly unlikely scenario, none of the proposed herbicides exceeded a HQ of 1, indicating a very low risk from direct contact.

Eating Contaminated Berries, Mushrooms or other Subsistence/Traditional Gathering Plant Resources

The public could be exposed to herbicide if they eat contaminated berries, mushrooms, or other plants. Directly sprayed plant materials would likely show signs of either dye (see pdf F6), or herbicide damage, reducing the likelihood they would be consumed. However, non-target berries or mushrooms could also be contaminated by drift or uptake from the soil, which would result in lower herbicide residues than direct spraying. The R6 2005 FEIS and the aminopyralid risk assessment considered both short- term acute exposure (eating 1 pound) and chronic 90 day consumption scenarios for eating contaminated berries. These scenarios also approximate the effects of eating other contaminated products, such as mushrooms (Durkin and Durkin 2005). None of the proposed herbicides would result in a hazard quotient greater than 1 for either acute or chronic exposures from eating contaminated berries, indicating potential consumption of plant materials with herbicide residues poses a low risk.

Hazard quotients greater than 1 were calculated for consumption of NPE surfactant at the highest acute exposures. Project design features would limit use of NPE to at or below the typical application rate, reducing this risk. Other pdfs to prevent public exposure include closure of recreation sites during application, use of dye in spray mixes, public notification, posting of treatment sites, supplying information during the special forest products permitting process, and coordination with the Native American Tribes.

People who harvest or use special forest products or cultural plants may have multiple exposures as a result of handling, chewing, and eating contaminated plant material. Such doses would be additive, but are still unlikely to exceed a threshold of concern (see the cumulative effects section that follows).

Drinking Contaminated Water

Acute and long-term exposures from direct contact or consumption of water following herbicide application were evaluated in the R6 2005 FEIS and the aminopyralid risk assessment. Risks from hypothetical drinking water sources were evaluated for: 1) a stream contaminated with herbicide residues by runoff or leaching from an adjacent herbicide application; and 2) drinking water from a pond contaminated by runoff or leaching. The risk assessments also evaluated an accidental exposure scenario where a small child drinks one liter of contaminated water from a quarter-acre pond where 200 gallons of herbicide was spilled.

The only scenario that resulted in HQs greater than 1 was the extreme example of the 200 gallon spill. A spill of this magnitude is not plausible and would be avoided by applying the pdfs that limit the amount of material allowed to be transported to treatment sites, and required safety measures. The potential risk of human health effects from any herbicide spill into drinking water would be avoided or mitigated by appropriate spill response identified in the spill response plan, periodic equipment inspections, and carrying an emergency response kit in vehicles transporting herbicides.

Drinking water sources would be further protected by pdf H9. Herbicide use would not occur within 100 feet of wells or 200 feet of spring developments. See chapter 3.5 for information on drinking water sources.

Consuming Contaminated Fish

Both acute and long-term exposure scenarios involving the consumption of contaminated fish were evaluated using the herbicide concentrations in the contaminated water scenarios described above. Acute exposure was based on the assumption that an angler consumes fish taken from contaminated water

shortly after an accidental spill into a pond. Chronic exposures were assumed to occur over a lifetime of eating contaminated fish. Native American subsistence groups were considered to have higher exposure rates than recreational anglers.

Some chemicals may be concentrated from contaminated water into the tissues of fish. This process is called bioconcentration. Bioconcentration at first increases with the length of exposure, but eventually reaches a constant maximum level. It is measured as the ratio of the concentration in the fish compared to the concentration in the water, referred to as the bioconcentration factor (BCF). A BCF less than or equal to 1 indicates that fish excrete a chemical faster than, or as fast as, they can absorb it and therefore no bioconcentration would occur.

Of the 11 proposed herbicides, three slightly exceed a BCF of 1 (chlorsulfuron has a BCF of 1.5; sethoxydim, a BCF of 7; and sulfometuron methyl, a BCF of 7). Hexachlorobenzene has a high BCF of 2,000, ranging from 2,000 – 20,000. The 2011 risk assessment for picloram (SERA 2011) quantitatively assessed chronic risk from HCB using a BCF of 20,000 for consumption of contaminated fish by subsistence populations. The HQ for carcinogenicity was 0.4; below the level of concern; however, because it occurs at such low levels in picloram (8 parts per million) and clopyralid (less than 2.5 parts per million) the risk from bioconcentration is low. Likewise, the HQ for clopyralid is below the level of concern (clopyralid has much less HCB than does picloram).

Bioconcentration was taken into account when determining exposures and resulting dose from eating contaminated fish for all herbicides; these results are shown in Appendix Q of the R6 2005 FEIS and the Aminopyralid Risk Assessment(SERA 2007).

The risk assessments found little risk from eating contaminated fish, under both the acute and chronic scenarios. Hazard quotients were less than or equal to 1 for all chemicals and situations evaluated, including a lifetime of subsistence fishing and cancer risk. Chapter 3.5 and 3.6 has more information about potential effects water quality and fish.

Multiple Chemical Sensitivity

The following information was adapted from USDA 2012, Gypsy Moth Management in the United Sates, a Cooperative Approach.

Some people feel that they suffer from Multiple Chemical Sensitivity (MCS), which is sometimes referred to as Idiopathic Environmental Intolerances (IEI). In general, individuals with MCS report that they experience a variety of adverse effects as a result of very low levels of exposure to chemicals (including herbicides) that are generally tolerated by individuals who do not have MCS.

Forest Service risk assessments incorporate an uncertainty factor of 10 to account for sensitive individuals, which may or may not eliminate risk that an individual may suffer symptoms. However, the uncertainty factor for sensitive individuals addresses variability in tolerances within a normal population. Individuals reporting MCS assert, either explicitly or implicitly, that they are atypically sensitive. There is no current consensus on the diagnosis and cause of MCS.

Until the etiology and pathogenesis of MCS has been clarified an organic cause of the MCS, associated symptoms and symptom complexes cannot be entirely ruled out. The Forest Service has no way to resolve concerns for MCS at the project level.

Endocrine Disruption

The Environmental Protection Agency has recently worked to establish appropriate tests and benchmarks for endocrine disruption effects. In 2009, they released a list of pesticides (based on the high potential for human exposure) that will be tested for potential to cause endocrine disruption. Glyphosate was the only

herbicide considered for use on the Malheur National Forest that was included in the initial EPA testing. Current status of these studies indicate that some tier-1 studies for glyphosate have been finished, some will not be finished until 2014, and some tier-2 studies have been ordered. Results are not yet available.

Potential effects to endocrine systems from chemicals are most often studied by evaluating toxic effects to estrogen, androgen, and thyroid hormone systems and changes in the structure of major endocrine glands (adrenal, hypothalamus, pancreas, parathyroid, pituitary, thyroid, ovary, and testis). In addition, the results of multigenerational studies can be indicative of potential endocrine disruption. Studies are lacking for most herbicides on the potential to bind to estrogen or androgen receptors. To the extent that data is available, the Forest Service risk assessments address endocrine effects for the proposed herbicides and are summarized here.

There is no evidence of direct effects to the endocrine system, nor reproductive or developmental effects from aminopyralid (SERA 2007), chlorsulfuron (SERA 2004a), imazapic (SERA 2004c), imazapyr (SERA 2011b), metsulfuron methyl (SERA 2004d), or picloram (SERA 2011c).

One study found that chlorsulfuron produced a slight decrease in fertility index in rats in a 3-generation study when rats were fed 125 mg/kg/day, but other studies have not found adverse effects on reproductive systems (SERA 2004a).

Clopyralid, sethoxydim, and triclopyr have not been found to cause reproductive effects at doses that do not also produce direct maternal toxicity, suggesting a direct toxic effect rather than an effect to the endocrine functions (SERA 2001, 2004b, 2011c).

Additionally, for Imazapyr, EPA states in their review of toxicity data that there was no evidence of estrogen, androgen and/or thyroid agonistic or antagonistic activity (US EPA/OPP 2005).

Some studies of sulfometuron methyl reported changes in rat testes, reproductive performance and in thyroid function (SERA 2004e). In specific reproductive studies with dietary exposures, there were no adverse effects to reproduction found (SERA 2004e).

Endocrine disruption and glyphosate was discussed in the updated Glyphosate Risk Assessment (SERA 2011a). SERA 2011 stated that “some recent studies raise concern that glyphosate and some glyphosate formulations may be able to impact endocrine function through the inhibition of hormone synthesis (Richard et al. 2005; Benachour et al.2007a, b), binding to hormone receptors (Gasnier et al. 2009), or the alteration of gene expression (Hokanson et al. 2007)” (all references as cited in SERA 2011). Evaluation of the studies indicates that endocrine disruption effects were indicated for surfactants in the formulations rather than glyphosate itself. “Most of the in vitro studies… assayed both glyphosate as well as glyphosate formulations, and most of the studies clearly indicate that the biological activity of glyphosate is less than that of glyphosate formulations” (SERA 2011). The studies that raise the most concern were from formulations not manufactured in the U.S. Based on the studies using formulations from outside the United States, “there is concern that glyphosate formulations may have an impact on these endpoints and that some of these effects could be seen under typical application conditions in the United States. In the absence of comparable studies on U.S. formulations, however, it is not clear whether the studies on glyphosate formulations used outside the United States are applicable to risks posed by U.S. formulations of glyphosate” (SERA 2011).

Additionally, there is a lack of specific information on the composition of different surfactants used in different formulations of glyphosate, as this information is identified as confidential business information. This lack of information limits the hazard identification for some toxic effects (SERA 2011). Given data limitations, the current practice of risk assessment is to use very protective exposure and dose scenarios, which are used in the 2011 glyphosate risk assessment and this analysis. Until more data on surfactants

becomes available, it is not clear that assessment relies on "the most toxic surfactant in the most sensitive species" for the quantitative analysis (SERA 2011).

On June 14, 2013, EPA released a revised second list of chemicals for screening tests. Picloram and HCB are the only chemicals on that list relevant to the proposed herbicide use on the Forest. EPA (2013) notes "this list should not be construed as a list of known or likely endocrine disruptors. Nothing in the approach for generating the initial list provides a basis to infer that by simply being on this list these chemicals are suspected to interfere with the endocrine systems of humans or other species, and it would be inappropriate to do so."

While the potential for the proposed herbicides to cause endocrine disruption effects is a current data gap, the potential for these effects are to actually occur are greatly reduced by measures such as required use of proper protective equipment, public notification, use of licensed applicators, limiting application rates and other relevant pdfs.

One type of surfactant used in several herbicide formulations is NPE. This complex of surfactants was analyzed in a risk assessment (Bakke 2003) and the R6 2005 EIS and its Appendix Q. NPE surfactants are formed through the combination of ethylene oxide with nonylphenol (NP). Both NP/NPE exhibit estrogen-like properties, although they are much weaker (1,000 to 100,000 times weaker) than natural estrogen. NP/NPE are used in industrial processing and are present in detergents and personal care products (moisturizers, deodorants, perfumes, shampoos, and soaps). Animal studies suggest that acute exposures at high levels may cause subclinical effects to the liver or kidneys. The risk analysis for NPE found that typical backpack application of herbicide containing NPE surfactant at typical exposures and a rate of 1.67 lbs./acre would add 0.1 to the cumulative HQ for these types of chemicals. For the public, values ranged between 0.00001 (eating contaminated fish) to 0.2 (consuming a pound of berries at typical exposures). These additions may be negligible depending on the background exposures, lifestyles, absorption rates, and other chemical exposures of workers and the public.

While data is limited regarding the potential for the proposed herbicides to cause endocrine disruption effects, is a current data gap, the potential for these effects are to actually occur are evaluated and accounted for by using protective thresholds (or toxicity values). Results of all herbicide risk assessments indicate that there is no evidence to suggest that these types of effects will occur from the proposed herbicides. Additionally, this project requires certain, greatly reduced by pdfs that reduce exposure, such as measures such as required use of proper protective equipment, public notification, use of licensed applicators, limiting application rates and other relevant pdfs.

Environmental Justice and Disproportionate Effects

The R6 2005 FEIS noted that some minority groups may be disproportionately exposed to herbicides, either because they are disproportionately represented in the pool of likely forest workers, or in the pool of special forest product or subsistence gatherers. The R6 2005 FEIS suggested that Hispanic/Latino forest workers and American Indians are minority groups that could be disproportionately affected by herbicide use. On the Malheur National Forest, Asian matsutake mushroom pickers and others who collect or use special forest products may also be disproportionately affected.

The potential exposures and effects to minority groups who apply herbicides or gather or use forest products are the same as those evaluated above under the worker and public herbicide exposure analysis sections. Even given plausible inadvertent acute or chronic exposures, minority forest workers, special forest product harvesters, and subsistence gatherers are not likely to be exposed to a dose that exceeds a threshold of concern. Project design features requiring public and tribal notification, use of dye in spray mixes, on-the-ground signing, and other rate restrictions on herbicide and NPE applications would further reduce the potential for exposure.

Direct and Indirect Effects of Alternatives

Alternative A – No Action

No invasive plant treatments would be completed under alternative A, so there would be no effects on human health from this project.

Alternative B – Proposed Action

Workers and the public may be exposed to the herbicides used to treat invasive plants under this alternative. However, no exposures exceeding a threshold of concern are predicted and no effects to human health are indicated. Aminopyralid is among the low-risk available herbicides relative to human health, so the addition of this herbicide in this alternative does not change the effect conclusions. The risk characterization takes into account the quantitative analyses and other information in the risk assessments and the implementation of project design features (table 9). Table 27 lists specific pdfs in alternative B that address human health concerns.

Table 27. Project design features in alternative b that address human health concerns

Concern	Project Design Features to Address Concern
Workers	· Limits on the application rates of chlorsulfuron, picloram, sulfometuron methyl, and NPE surfactants. · Aminopyralid is used in lower rates than other herbicides, which reduces potential exposure to workers · Safety Plan, Emergency Spill Response Plan, Emergency Spill Kit, Personal Protective Equipment required. · Traffic control and signing as needed.
Public	· Limits on the application rates of NPE surfactants. · Aminopyralid is used in lower rates than other herbicides, which reduces potential exposure to the general public · Public notification · Treatment areas posted · Use of blue dye · Recreation sites closed during application · Safety Plan, Emergency Spill Response Plan and Emergency Spill Kit required.
Cultural Use Plants	· Public measures above plus: Tribal review and coordination to avoid herbicide use in cultural plant collecting areas.
Drinking Water	· Herbicide-use buffers · Herbicide use would not occur within 100 feet of wells or 200 feet of spring developments. · Safety Plan, Emergency Spill Response Plan, and Emergency Spill Kit required.

Alternative C

Workers and the public may be exposed to the herbicides used to treat invasive plants in this alternative. However, no exposures exceeding a threshold of concern are predicted. This conclusion is based on facts about the chemistry of the herbicides considered for use and the mechanisms by which exposures of concern might occur. Since there would be less herbicide use overall, there would be less risk of exposure associated with alternative C, however the difference in impact on human health would not be measurable or meaningful.

Alternative D

Workers and the public may be exposed to the herbicides used to treat invasive plants in this alternative. The following table compares the use of herbicides under alternatives B and D and shows that less broadcasting overall would occur due to the loss of aminopyralid as an option in infested areas that lie near streams or other water bodies. However, this would do nothing to mitigate human health risks from the proposed action. In addition, about 63 acres would be treated with picloram as a first-choice herbicide. Concerns about picloram were discussed in the previous section; the 63 acres of picloram that would be the first year/first choice herbicide would not result in meaningful or measurable harm to workers or the public. About 725 acres of glyphosate would be the first-choice herbicide under alternative D. Some people have expressed concerns about overuse of glyphosate in general in Oregon; however the extent of use on this project would have no measurable impact on human health.

Cumulative Effects

Alternative A would have no cumulative effects on human health. The proposed use of herbicides in all action alternatives could result in cumulative doses of the same or different herbicides to workers or the general public. Cumulative doses are possible within the context of this project, or when combined with herbicide use on adjacent private lands or home use by a worker or member of the general public. However, the risk is very small that a person would receive additive exposures during the time period in which the herbicide remains un-metabolized in their body. These herbicides do not bio-accumulate in humans and are rapidly eliminated from the body. Chronic (daily over a period of time) worker exposure was considered in SERA Risk Assessments; chronic exposures do not amount to levels of concern because the herbicide ingredients are water-soluble and are not retained in the body (they are rapidly eliminated).

The SERA Risk Assessments evaluated chronic exposure scenarios that would involve the public, including repeated drinking of contaminated water, repeated consumption of contaminated berries, and repeated consumption of contaminated fish. The potential for cumulative human health effects from any herbicide use proposed in this EIS, combined with other potential herbicide applications in the analysis area, is encompassed in the health risks estimated for chronic exposure scenarios. A person could be exposed to herbicides by more than one scenario; for instance, a person handling, and then consuming sprayed berries. The cumulative impact of such cases may be quantitatively characterized by adding the HQs for each exposure scenario. The herbicides together would not bioaccumulate.

Using glyphosate as an example, the typical levels of exposure for a woman being directly sprayed on the lower legs, staying in contact with contaminated vegetation, eating contaminated fruit, and consuming contaminated fish leads to a combined (acute) HQ of 0.012. Similarly, for all of the chronic glyphosate exposure scenarios, the addition of all possible pathways lead to HQs that are two orders of magnitude less than 1, indicating an acceptable level of cumulative risk even with multiple exposure scenarios.

Even if a herbicide with a greater hazard quotient than glyphosate were used, berry harvesting (dermal exposure) and the subsequent eating (oral exposure) would allow the body to metabolize some of the initial dose before receiving the second dose, thus reducing the cumulative dose. These factors make the risk implausible that a combined dose would exceed the threshold of concern. Slight exceedences could cause clinically detectable physiologic changes, but are unlikely to produce any human health symptoms detectable by a person.

The R6 2005 FEIS considered the potential for synergistic effects of exposure to two or more chemicals: “Combinations of chemicals in low doses (less than one tenth of RfD) have rarely demonstrated synergistic effects. Review of the scientific literature on toxicological effects and toxicological interactions of agricultural chemicals indicate that exposure to a mixture of pesticides is more likely to lead to additive rather than synergistic effects (ATSDR, 2004; U.S.EPA/ORD, 2000). Based on the limited

data available on chemical combinations involving the twelve herbicides considered in this EIS, it is possible, but unlikely, that synergistic effects could occur as a result of exposure to the herbicides considered in this analysis. Synergistic or additive effects, if any, are expected to be insignificant" (R6 2005 FEIS p. 4-3). Additional information about herbicide use on other land ownerships in Oregon and potential for cumulative effects is in chapter 3.1.5. The ongoing and foreseeable projects and activities within the project area would not combine with this project and cause cumulative effects of concern to human health.

3.3 Botany

3.3.1 Introduction

This section summarizes the findings of a biological evaluation and botany specialist report prepared to document potential effects from implementing the proposed alternatives to fungal, lichen, and plant species that are federally listed as threatened, endangered, or proposed for federal listing under the Endangered Species Act of 1973, as amended, and also to fungal, lichen, and plant species identified as sensitive on the regional forester's special status species list (USDA Forest Service 2011). These species are collectively referred to as sensitive plants. This section also addresses effects on plants that are culturally significant to local Native American tribes, special forest products (non-timber forest products), and plant pollinators. These are often referred to as species of concern. Effects on common non-target plants are also discussed.

Endangered Species Act (Federally Listed Species)

No documented populations or potential habitat exists on the Malheur National Forest for any fungal, lichen, or plant species federally listed or proposed for listing under the Endangered Species Act. Hence, consultation with the U.S. Fish and Wildlife Service is not necessary.

Forest Service Designated Sensitive Species

This analysis addresses plant species designated as sensitive on the Pacific Northwest Region 6 Regional Forester's Special Status Species List (USDA Forest Service 2011). The list includes vascular plants, nonvascular plants (mosses and liverworts), lichens, and fungi. They are referred to here as "sensitive plants." There are currently 88 species of sensitive plants documented, or suspected to occur, on the Malheur National Forest. All federally proposed, listed endangered or listed threatened plant species (as defined by the Endangered Species act of 1973) are included on this list. Effects analysis determinations follow definitions as outlined in Forest Service Manual 2672.42.

Although there is a small chance of negative impacts to sensitive plant species from activities proposed in any of the action alternatives (MIIH), the potential of negative impacts is relatively small. The areas that would be treated are a small percentage of the known populations and potential habitat for sensitive plants species. Therefore, although the project may impact individuals and habitats for sensitive plants, implementation of any alternative would not result in a trend toward federal listing of any sensitive plant. The selection of any action alternative would not lead to a reduction in the long-term viability of any sensitive plant species on the Malheur National Forest.

Regulatory Framework and Compliance

All alternatives would allow for the continued viability of native vegetation, sensitive plants, special forest products and pollinators on the Malheur National Forest. All alternatives comply with the Malheur National Forest Land and Resource Management Plan.

3.3.2 Affected Environment

Native Vegetation

The Malheur National Forest located in east central Oregon contains a wide diversity of plant species and communities due to varying elevation and precipitation zones that occur within eastern Oregon. Elevations on the Forest vary from 3,900 feet (at the Forest boundary south of Mt. Vernon, Oregon) to 9,038 feet on Strawberry Mountain. The result is a diverse and productive landscape of grasslands, sage, and juniper; as well as forests of pine, fir, and other tree species, and mountain lakes and meadows. Given this combination of physiography and climate, habitats are highly variable and retain a legacy of botanical diversity.

Since the time of the first movement of people into the area and the associated establishment and spread of invasive weeds along vectors (highways, railroads, canoes, rafts, and other transportation methods), invasive plants have altered habitats and vegetation types across the landscape. For example, many areas within the forest have become permanently altered by annual grasses, which have become naturalized. In certain instances this permanent alteration of habitat has affected native vegetation (Olson 1999). Eastside forests are more susceptible to invasive plants than other forests in the region (R6 2005 FEIS), because their grasslands, riparian areas, and relatively dry, open forests (with frequent gaps in the plant cover), favor invasive plant establishment (R5 FEIS 2005). The moist forests and high montane areas have relatively closed plant cover or have extreme climate or soils, which are tolerated by fewer invasive plant species. Invasive plants tend to colonize disturbed ground along and around developments such as roads, highways, utility (powerline) corridors, recreational residences, trails, campgrounds and quarries. These are all places where native vegetation has been removed and disturbance has created areas for invasive plants to establish. The susceptibility of plant communities to invasion can also be influenced by community structure, and the biological traits of the invader species.

Plant communities can be classified by a variety of factors such as vegetation structure, site moisture, overstory, and understory. The 2005 FEIS used broad potential vegetation groups (PVGs) to rate the susceptibility of vegetation to invasive plant establishment. Table 28 lists potential vegetation groups (PVG) found on the Malheur National Forest, their susceptibility to damage from invasive plants, the local plant community types that correspond to these broad PVG types, and mapped acres of invasive plants within the plant community types. The groups are aggregations of plant associations and represent a combination of temperature and moisture regimes for this Forest. Overall, most plant community types found on the Malheur National Forest are moderately to highly susceptible to invasion.

Table 28. Potential Vegetation Groups on the Malheur National Forest's 1.7 million acres and their susceptibility to invasive plants

Potential Vegetation Group	Percent of Forest	Susceptibility to Invasion[1]	Infested acres (all species)[2]
Cold forest	2	Moderate	5
Cold herbland	0.1	Moderate	0.1
Cold shrubland	0.2	Moderate	0.3
Cool-cold riparian forest	0.000007	Moderate-high	0
Cool-cold riparian herbland	0.0002	Moderate-high	0.06
Dry Douglas-fir forest	16	Moderate-high	290
Dry grand-fir forest	24	Moderate-high	503
Dry ponderosa pine forest	21	Moderate-high	457
Hot-dry pine forest	10	Moderate-high	136
Dry herbland	2	High	29

Potential Vegetation Group	Percent of Forest	Susceptibility to Invasion[1]	Infested acres (all species)[2]
Dry shrubland	6	High	43
Juniper woodland	3	Moderate-high	28
Moist forest	13	Moderate-high	456
Moist herbland	0.55	Moderate-high	18
Moist shrubland	0.8	Moderate	29
Warm-hot riparian herbland	1	High	74
Warm-hot riparian forest	0.00003	Moderate-high	0.3
Warm-hot riparian shrubland	0.0009	High	26
Whitebark pine forest	0.4	Moderate-high	0.4
Total	**100.0**		

1 Susceptibility ratings (derived from R6 2005 FEIS): High = high susceptibility to invasion. Invasive plant species invade the cover type successfully and becomes dominant or co-dominant even in the absence of intense or frequent disturbance; Moderate = moderate susceptibility to invasion. Invasive plant species

is a "colonizer" that invades the cover type successfully following high intensity or frequent disturbance that impacts the soil surface or removes the normal canopy; Low = low susceptibility to invasion. Invasive weed species does not establish because the cover type does not provide suitable habitat.

2 Some mapping error due to overlap in species occurrences in duplicate potential vegetation groups in GIS database

Sensitive Plants

The following sources of information were used to determine which sensitive plant species, and their respective habitats, may occur within the project area.

- The Regional Forester's Sensitive Species List (USDA Forest Service 2011)[18]
- The Forest Service's Natural Resource Manager Database (NRM) – Threatened, endangered, and sensitive species geographic information system (GIS) database, and other pertinent GIS mapping layers (potential natural vegetation, streams and wetlands, aerial imagery).
- Project GIS layer showing proposed treatment areas.

Table 29. Sensitive plant populations within 100 feet of proposed invasive treatment areas

5th Field Watershed	Sensitive Plant Species	Invasive Species	Distance Between Species
Bridge Creek - 1707020301	Blandow's feather moss (*Helodium blandowii*)	Hound's tongue (*Cynoglossum officinale*)	30 feet – 1 site
Fields Creek John Day River - 1707020110	Colonial luina (*Luina serpentina*)	Dalmatian toadflax (*Linaria dalmatica*)	57 feet – 1 site
		Spotted knapweed (*Centaurea stoebe ssp. micranthos)*	51 feet – 1 site
Headwaters Silvies River - 1712000201	Crenulate moonwort (*Botrychium crenulatum*)	Canada thistle (*Cirsium arvense*)	54 feet – 1 site
Upper Silvies River - 1712000203	Idaho sedge (*Carex idahoa*)	Canada thistle (*Cirsium arvense*)	0 feet – 1 site
		Hound's tongue	0 feet – 1 site

[18] Forest Service Manual 2670.5 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, density, or habitat capability that would reduce a species existing distribution.

5th Field Watershed	Sensitive Plant Species	Invasive Species	Distance Between Species
		(*Cynoglossum officinale*)	
	Deschutes milk vetch (*Astragalus tegetarioides*)	Dalmatian toadflax (*Linaria dalmatica*)	0 feet – 3 sites
Middle Silvies River - 1712000204	Deschutes milk vetch (*Astragalus tegetarioides*)	Spotted knapweed (*Centaurea stoebe ssp. micranthos)*	0 feet – 1 site
		White-top (*Cardaria draba*)	79 feet – 1 site
Emigrant Creek - 1712000205	Peck's long-bearded sego lily (*Calochortus longebarbatus* var. *peckii*)	Yellow toadflax or Butter-and-eggs (*Linaria vulgaris*)	0 feet-3 sites
North Basin - 1712000101	Deschutes milk vetch (*Astragalus tegetarioides*)	Dalmation toadflax (*Linaria dalmatica*)	0 feet – 1 site

Table 30 that follows lists all Region 6 sensitive plant species that are documented or suspected to occur on the Malheur National Forest.

Table 30. Sensitive plant species documented (D), suspected (S), or having a historical record (H) on the Malheur National Forest

Malheur National Forest Sensitive Plant Species			
Taxa Type	**Scientific Name**	**Common Name**	**Occurrence on the Forest[1]**
Fungus	*Pseudorhizina californica*	umbrella false morel	S
Lichen	*Texosporium sancti-jacobi*	woven spore lichen	S
Liverwort	*Anastrophyllum minutum*	tiny notchwort	S
Liverwort	*Anthelia julacea*	alpine silverwort	S
Liverwort	*Barbilophozia lycopodioides*	giant fourpoint, maple liverwort, greater pawwort	S
Liverwort	*Harpanthus flotovianus*	great mountain flapwort	S
Liverwort	*Jungermannia polaris*	Arctic flapwort	S
Liverwort	*Lophozia gillmanii*	Gillman's pawwort	S
Liverwort	*Peltolepis quadrata*	shieldscale liverwort	S
Liverwort	*Preissia quadrata*	blister ribbon, narrow mushroom-headed liverwort	D
Liverwort	*Ptilidium pulcherrimum*	lovely fuzzwort, naugahyde liverwort	S
Moss	*Encalypta brevipes*	candle snuffer moss, stubby extinguisher moss	S
Moss	*Entosthodon fascicularis*	banded cord-moss, Hasselquist's hyssop	S
Moss	*Helodium blandowii*	Blandow's feather moss, wet plume moss	D
Moss	*Meesia uliginosa*	Meesia moss	D
Moss	*Pseudocalliergon trifarium*	blunt water moss, worm moss	S
Moss	*Schistidium cinclidodonteum*	schistidium moss	S

Malheur National Forest Sensitive Plant Species			
Taxa Type	**Scientific Name**	**Common Name**	**Occurrence on the Forest[1]**
Moss	*Schistostega pennata*	schistostega moss	S
Moss	*Splachnum ampullaceum*	purple-vased stink moss, small capsule dung moss	S
Moss	*Tetraphis geniculata*	tetraphis moss	S
Moss	*Tomentypnum nitens*	tomentypnum moss	D
Moss	*Tortula mucronifolia*	mucron-leaf tortula moss	S
Vascular	*Achnatherum hendersonii*	Henderson's ricegrass	S
Vascular	*Achnetherum wallowaense*	Wallowa ricegrass	S
Vascular	*Artemisia arbuscula* ssp. *longicaulis*	Lahontan sagebrush	S
Vascular	*Astragalus tegetarioides*	Deschutes milkvetch, bastard milkvetch	D
Vascular	*Botrychium ascendens*	upward-lobed moonwort	D
Vascular	*Botrychium crenulatum*	crenulate moonwort	D
Vascular	*Botrychium hesperium*	western moonwort	S
Vascular	*Botrychium lineare*	slender moonwort	S
Vascular	*Botrychium lunaria*	common moonwort	D
Vascular	*Botrychium montanum*	mountain moonwort	D
Vascular	*Botrychium paradoxum*	twin-spiked moonwort	S
Vascular	*Botrychium pedunculosum*	stalked moonwort	S
Vascular	*Bupleurum americanum*	American thorough-wax	S
Vascular	*Calochortus longebarbatus* var. *longebarbatus*	long-bearded sego-lily	S
Vascular	*Calochortus longebarbatus* var. *peckii*	Peck's long-bearded sego-lily	D
Vascular	*Camissonia pygmaea*	dwarf evening-primrose	S
Vascular	*Carex atrosquama*	blackened or brass-fruit sedge	S
Vascular	*Carex cordillerana*	cordilleran sedge	D
Vascular	*Carex diandra*	lesser panicled sedge	S
Vascular	*Carex idahoa*	Idaho sedge	D
Vascular	*Carex lasiocarpa* var. *americana*	slender wooly sedge	S
Vascular	*Carex media*	Scandinavian sedge	S
Vascular	*Carex micropoda*	timberline sedge	S
Vascular	*Carex nardina*	spikenard sedge	S
Vascular	*Carex pelocarpa*	dusky-seed or new sedge	S
Vascular	*Carex retrorsa*	retrorse sedge	S
Vascular	*Carex saxatilis*	russet sedge	S
Vascular	*Carex scirpoidea* ssp. *stenochlaena*	Alaska single-spiked sedge	D
Vascular	*Carex subnigricans*	nearly black or dark alpine sedge	S
Vascular	*Carex vernacula*	native sedge	S
Vascular	*Chaenactis xantiana*	desert chaenactis	S
Vascular	*Cheilanthes feei*	Fee's lip fern	S
Vascular	*Cistanthe rosea*	rosy pussypaws	H
Vascular	*Cryptogramma stelleri*	Steller's rock-brake	S

Malheur National Forest Sensitive Plant Species			
Taxa Type	**Scientific Name**	**Common Name**	**Occurrence on the Forest[1]**
Vascular	*Cymopterus nivalis*	snowline cymopterus	D
Vascular	*Cypripedium fasciculatum*	clustered lady's-slipper	S
Vascular	*Elatine brachysperma*	short-seeded waterwort	S
Vascular	*Eleocharis bolanderi*	Bolander's spike-rush	D
Vascular	*Eriogonum cusikii*	Cusick's buckwheat	S
Vascular	*Eriogonum salicornioides*	playa or saltwort buckwheat	S
Vascular	*Heliotropium curassavicum*	salt heliotrope	S
Vascular	*Kobresia myosuroides*	Bellard's kobresia	S
Vascular	*Listera borealis*	northern twayblade	D
Vascular	*Lomatium erythrocarpum*	red-fruited desert-parsley	S
Vascular	*Luina serpentina*	colonial luina	D
Vascular	*Lupinus cusickii* var. *cusickii*	Cusick's lupine	S
Vascular	*Lycopodium complanatum*	ground-cedar	S
Vascular	*Mimulus evanescens*	disappearing monkey-flower	S
Vascular	*Muhlenbergia minutissima*	annual or little-seed muhly grass	S
Vascular	*Ophioglossum pusillum*	adder's-tongue	S
Vascular	*Pellaea bridgesii*	Bridge's cliff-brake	S
Vascular	*Phacelia minutissima*	least or dwarf phacelia	D
Vascular	*Phlox hendersonii*	Henderson's phlox	S
Vascular	*Phlox multiflora*	many-flowered phlox	S
Vascular	*Pinus albicaulis*	whitebark pine	D
Vascular	*Pleuropogon oregonus*	Oregon semaphore grass	S
Vascular	*Potamogeton diversifolius*	diverse-leaved pondweed	S
Vascular	*Rotala ramosior*	lowland toothcup	S
Vascular	*Salix farriae*	Farr's willow	S
Vascular	*Salix wolfii*	Wolf's willow	S
Vascular	*Saxifraga adscendens* ssp. *oregonensis*	wedge-leaved saxifrage	S
Vascular	*Stanleya confertiflora*	biennial stanleya	S
Vascular	*Thelypodium eucosmum*	arrow-leaf thelypody	D
Vascular	*Trifolium douglasii*	Douglas' clover	S
Vascular	*Trollius laxus* ssp. *albiflorus*	American globeflower	S
Vascular	*Utricularia minor*	lesser bladderwort	S

Botanical Surveys

Sensitive plant botany surveys have not been completed in most of the areas proposed for invasive species treatments. These areas were inventoried for the invasive species, but not for sensitive species. Some selected locations targeted for treatment did receive sensitive plant surveys in 2013. No overlap between sensitive plant populations and invasive plant populations were found during these surveys (NRM database 2013).

Project design features stipulate that site-specific surveys for sensitive plants will be conducted prior to project implementation. In areas with high potential for sensitive plant species habitat, a Forest Service

botanist or otherwise qualified person will examine all areas of potential ground disturbance or herbicide application at the appropriate time of the year to identify targeted sensitive plant species before implementation.

Culturally Significant Plants

Traditional cultural plants such as bitterroot (*Lewisia rediviva*), biscuitroot (*Lomatium* spp.), camas (*Camassia quamash*), chokecherry (*Prunus emarginata*), and huckleberry (*Vaccinium membranaceum*) are found in the project area. These and other culturally important plants are collected and used by Native American tribal members and the general public as food, medicine, or in ceremonial activities. These species occur in various habitats across the Malheur National Forest. Specific locations where these species occur are not mapped or tracked by the Forest. No permits are required to collect these species for personal use.

Special Forest Products

Special forest products include all non-timber products that require a permit for commercial or personal use collecting. This includes firewood, posts and poles, Christmas trees, pine cones, burls, mushrooms, and commercial collecting of medicinal or food plants. Also included are permits for collection of seeds, cuttings, or whole plants for propagation or landscaping. Decorative rocks and landscaping rocks are also collected under permit. Permits are not required for small quantities of mushrooms (less than one gallon per day), huckleberries, and other roots and fruits. The most common special forest product collected in the Malheur National Forest is firewood, followed by posts and poles. Mushroom permits are generally sold in quantity after wild fires, when morel mushrooms are in abundance. These activities may occur in the same general vicinity where invasive species treatments may be implemented. Specific locations where these species occur are not mapped or tracked by the Malheur National Forest.

Pollinators

A reduction or shift in pollinator species could lead to changes in plant species composition or diversity (USDA Forest Service 2005a, 4-27). Native pollinators have co-evolved with the plants they visit, such that their physiology is matched to most efficiently exploit the nectar and pollen resources of the flowers upon which they specialize. It is highly likely that reduced species diversity from invasive plants has indirect negative effects on pollinators.

Many invasive plants are early successional species, meaning they colonize areas that have been recently disturbed. Since invasive plants have the ability to deplete available resources to lower levels than native vegetation can tolerate, they can quickly dominate disturbed sites and displace native vegetation. When invasive plants dominate native plant communities, native plant species diversity is decreased. The North American Pollinator Protection Campaign (2006) determined that invasive plants, left untreated, shift species composition and affect pollinated plants by disrupting the structure and function of ecosystems.

Colony Collapse Disorder

Pesticides are one of several factors thought to possibly contribute to catastrophic losses of honey bees, known as “colony collapse disorder” or CCD, reported since 2006. Thus, a discussion of the possible connection of herbicide use proposed for the action alternatives and CCD is warranted.

The European honey bee (*Apis mellifera*) is not native to the American continents, but was introduced by European settlers in the 1600s. It is widely distributed and commercially produced in the U.S. with escaped feral colonies formerly present across most of the country (parasitic mites have destroyed most of the feral honey bees across the United States (CCD Steering Committee 2007)). The honey bee is used to pollinate agricultural crops and produce honey. The honey bee adds about $15 billion in value to agricultural crops each year (Morse and Calderone 2000).

In 2006-2007, commercial honey bees in North America, and other parts of the world, experienced alarming declines characterized by the disappearance of adult bees from the hives with no or few dead bees near the hive; healthy, capped brood; food reserves that have not been robbed; minimal evidence of wax moth or hive beetle damage; and a laying queen with immature bees and newly emerged attendants (CCD Steering Committee 2007, Winfree et al. 2007). This phenomenon has been termed "colony collapse disorder." By 2007, almost 30 percent of beekeepers in the U.S. reported losses of up to 90 percent of their colonies (Cox-Foster et al. 2007; Winfree et al. 2007). CCD has not been reported in wild native bees (Winfree et al. 2007).

Suspected causes of CCD include the following factors, alone or in combination: 1) environmental and nutritional stress; 2) new and /or re-emerging pathogens; 3) pests that attack bees; and 4) pesticides (CCD Steering Committee 2007). Several major setbacks to honey bee populations over the last two decades have combined to increase stress on the remaining hives, as they are moved and worked for their pollination services over longer seasons and larger geographic areas. Climate change, drought, and unseasonably cold weather combine to create increased stress on bee populations. Commercial bees are often fed high fructose corn syrup, which may contribute to some nutritional deficiencies. Nutritional deficiencies are thought to make the bees more susceptible to attack from pathogen and anecdotal evidence indicates that hives that are fed nutritional supplements over the winter are more resistant to CCD (Anonymous 2009).

Pathogens are primary suspect because CCD is transmissible to other hives through the reuse of equipment from CCD-affected colonies, and such transmission can be broken by irradiation of the equipment before use (Pettis et al. 2007). A recent paper using current gene technology has indicated that Israeli acute paralysis virus is strongly correlated with CCD and is a current leading candidate for its cause, alone or in combination with other factors (Cox-Foster et al. 2007, Kaplan 2008). Another recent paper implicates an infection from the parasite *Nosema ceranae*, but losses from CCD in hives treated for this parasite may differ between European and American hives (Higes et al. 2009, Goodman 2009).

Pests including the varroa mite, small hive beetle, wax moth, and others stress bees and may harbor infectious agents. In particular, the varroa mite has been responsible for catastrophic losses of 50 to 100 percent in many beekeeping operations and has eliminated most feral bee colonies. In addition, the varroa mite is known to carry pathogens transmitted to bees and is thought to suppress the immunity of honey bees (Shen et al. 2005).

Pesticide exposure may affect bees through direct toxicity or by adding additional stress. Beekeepers treat hives with miticides and fungicides and bees may be exposed to pesticides while foraging on agricultural crops. Currently, the classes of pesticides thought to be the most likely contributors to, and being researched for correlation with, CCD include insecticides, miticides, and fungicides (CCD Steering Committee 2007). Recent research has found higher-than-expected levels of miticides and traces of a wide variety of agricultural chemicals in bee hives, but no consistent pattern in levels or types of chemicals identified (Kaplan 2008).

3.3.3 Environmental Consequences

Methodology

There is no potential habitat on the Malheur National Forest for any federally listed or proposed plant species. All alternatives for this project comply with Forest Plan standards and guidelines and Forest Service direction for management of sensitive plants and special forest products. Therefore, there is no effect from any of the alternatives to federally listed threatened, endangered, or plants proposed for federal listing. Hence, consultation with the U.S. Fish and Wildlife Service is not necessary for federally listed or proposed plants.

The four possible effect calls for sensitive plants are outlined in Forest Service Manual 2670. These definitions were used to guide the determination of effects:

§ NI - Species that occur in habitats which are not expected to be directly or indirectly affected in any way, are given a “No Impact” determination.

§ BI - Species and their potential habitats that could be favorably affected by a particular alternative are given a determination of “Beneficial Impact”.

§ MIIH - Species and potential habitat that could possibly be negatively affected are given a determination of “May impact individuals or habitat, but will not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species”. This call is used in cases where there is unsurveyed potential habitat, or where potential impacts are uncertain, or considered to be relatively minor.

This acknowledges that the action could have negative impacts, but due to (1) the complexity of the proposed action, (2) the differential impacts across the landscape and (3) the lack of best available science, the degree and consequence of the negative impacts are not known with certainty. Additionally, this recognizes that even the most substantial impacts of the proposed action will not contribute to a trend toward listing the species under the Endangered Species Act. The effects are expected to be minor enough that they will not cause a loss of viability of the species in the planning area.

§ WIFV - Species and habitat that will most likely be negatively affected by the project, a determination of “Will impact individuals or habitat with a consequence that the action may contribute to a trend towards federal listing, or cause a loss of viability to the population or species”. This call is used in cases where negative impacts will clearly occur, and they are of a magnitude that they may cross a threshold leading to Federal Listing under the Endangered Species Act.

Since all of the action alternatives include similar activities and project design features, the analysis will focus primarily on a general discussion of potential effects. Then the individual alternatives will be compared in relation to the amount of area, and various herbicides proposed for treatment under each alternative.

Incomplete and Unavailable Information

Invasive plant sites and known populations of sensitive plant species on the Malheur National Forest have typically been mapped with an accuracy of 100 feet, or better. Small mapping errors may mean that sites on the ground are actually further apart or closer together than displayed in GIS. Additionally, invasive species and sensitive plant populations may expand or contract over time. Confirmation of the exact location of known sensitive plant sites will occur during planning, treatment, and monitoring of sites.

The only sensitive fungus currently suspected on the Malheur National Forest is the umbrella false-morel (*Pseudorhizina californica*). Fungi only fruit under very specific moisture and temperature conditions. Therefore, it is very difficult to locate species of fungi because of their ephemeral nature. It is very possible that there are undocumented populations of the umbrella false-morel on the Forest.

Some sensitive plant species don’t produce above-ground plants every year. These plants include some grape-ferns (*Botrychium spp.*), and many annual species which are dependent upon sufficient early spring rains, Some of the annual sensitive species include least phacelia (*Phacelia minutissima*), disappearing monkeyflower (*Mimulus evanescens*), dwarf evening-primrose (*Camissonia pygmaea*) annual muhly

grass (*Muhlenbergia minutissima*), lowland tooth-cup (*Rotala ramosior*), and desert chaenactis (*Chaenactis xantiana*).

Some species, such as the least phacelia, annual muhly grass, and grapeferns, are so tiny and difficult to find in dense vegetation that even expert botanists may overlook them during surveys. Many of the non-vascular plants are very difficult to identify; it is possible that botanists may also overlook some of these species. For these reasons, it is not possible to state with 100 percent certainty that all sensitive plant species will be detected during sensitive plant surveys.

Information about the effects of the proposed herbicides on lichens, bryophytes, and fungi is generally lacking. Data on the susceptibility of different nontarget plant species and families to particular herbicides is conducted with agricultural crop species and not those that may better represent nontarget plants in the natural environment.

Spatial and Temporal Context for Effects Analysis

The spatial context for this analysis is the entire area managed by the Malheur National Forest. This scale is large enough to identify trends to botanical species of conservation concern that could result from implementing this project. The temporal context for effects analysis includes short-term and long-term effects. Short-term effects for this analysis are considered to be 1 to 2 years after treatment. Long-term effects for this analysis are considered to be longer than 2 years.

Effects to Sensitive Plants Common to All Action Alternatives

All of the action alternatives allow the use of manual, cultural, and mechanical control of invasive species. In addition, all action alternatives allow various amounts of herbicide treatment. Project design features for sensitive plants are the same for all action alternatives. The potential direct and indirect effects discussed below therefore apply to all alternatives.

Unless otherwise cited, information in this section incorporates by reference analysis discussed in Section 4.3 and Appendix J of the R6 2005 FEIS (USDA Forest Service 2005a).

All invasive plant treatments are designed to kill or prevent growth and reproduction of target plants. During treatment implementation, direct effects to adjacent non-target plant species may also occur. In most cases, impacts to non-target plants would be minor, and would occur in the immediate vicinity of the treated site. To help minimize effects to sensitive plant species, surveys will be conducted in potential habitat for sensitive plants before treatments. Monitoring and adaptive management are also important components of all alternatives that will allow for improving project implementation as more information is collected. In addition, project design features would help to reduce the risk of impacts to sensitive plant populations and habitats.

A beneficial indirect effect of proposed treatments is that non-target plants would increase growth and abundance as competition from invasive plants is reduced. This would result in restoration of native plant communities as invasive species are controlled or eliminated. Overall, the short-term negative effects of treatments are expected to be less than the long-term indirect benefits of removing invasive plants.

Manual and Mechanical Control Effects

All alternatives include manual and mechanical control. Manual control includes hand pulling, grubbing with tools such as a shovel or hoe, and removing and bagging seed heads. Mechanical control includes the use of equipment such as mowers or string trimmers.

Control of invasive plants using manual or mechanical methods may potentially directly affect non-target plants. Direct negative effects may include mortality of individuals, reduced vigor due to trampling or

removal of above ground parts, and reduced seed production. These effects would be minor with manual control and mechanical control using string trimmers. There would be less ability to target individual plants with mowing, resulting in greater risk of potential negative effects to non-target plants in the treated area.

The project design feature Group I are designed to ensure that botanical surveys occur when warranted before project implementation , which will greatly reduce the possibility of these activities negatively impacting sensitive plants. Additional protection will be provided by the pdf that provides for buffers of known sensitive plant sites (table 9).

Indirect effects of manual and mechanical methods include soil disturbance and reduced plant cover and shading. Depending on the magnitude of the disturbance, indirect effects may also reduce soil productivity, change the capacity of the soil to hold moisture, and lead to disruption of mycorrhizal and bacterial soil activities and increases in soil surface temperatures. These changes may promote germination of invasive plant seeds in the seed bank, or provide sites for additional invasive species to become established. Because manual controls would be used primarily on small or low-density infestations of non-rhizomatous species, and mechanical control would be used on selected sites in combination with other methods, these negative effects are likely to be minor. Over time, with repeated treatments, reduction of invasive species through manual and mechanical control would likely provide space for increased germination and growth of native plant species.

Cultural Control Effects

Cultural control techniques proposed in the action alternatives include mulching, seeding, planting, and solarization (covering areas with black plastic). Direct and indirect effects from these activities are similar to manual and mechanical control effects and are not likely to substantially impact sensitive plants (see R6 2005 FEIS Appendix J).

Effects of Biological Control Agents

Biological control agents would be authorized under all action alternatives. Most of the agents available for control of invasive species have previously been released in or near the project area, so many are already present on the Forest. Under alternative A-no action, biological control agents will not be deliberately released.

The analyses of the environmental effects of biological control agents have been completed under documents developed by Agricultural Plant Health and Insect Service (APHIS) for approval of their use. The completed environmental impact statements are available at: http://www.aphis.usda.gov/ppq/enviro_docs/index.html.

Even though control agents are reviewed and approved by APHIS prior to release in this country, there is a slight risk that an approved agent may unintentionally affect native plants or animals. There also remains the possibility that regardless of what the Forest Service does, unapproved agents or agents known to affect non-target plants could spread from neighboring lands onto National Forest System lands.

Herbicide Control Effects

Under alternative A-no action, herbicide use will no longer be authorized on the portions of the Ochoco National Forest administered by the Malheur National Forest, but may occur along State road rights-of-way and easements as a part of ongoing actions.

All action alternatives include some herbicide control. The action alternatives allow various chemicals and levels of chemical use across the Malheur National Forest. The potential for negative effects from herbicide use increases directly in relation to how many acres are treated, and the toxicity of various

chemicals. Effects on non-target plants would vary based on the herbicide properties, application rate, timing of application, application method, site conditions, and the susceptibility of the non-target plants. Use of non-selective herbicides with residual soil activity and relatively high risk for offsite effects could result in the most damage to non-target plant species. Use of selective herbicides could shift the composition of the plant community, as less tolerant species are replaced by more tolerant species. At many herbicide-treated sites, selective herbicides would result in greater impacts to native broad-leaved forbs than trees, shrubs, or grasses.

Forest roads facilitate the spread of invasive plants; they have a substantial effect on the establishment and subsequent invasion by providing prime habitat for colonization and serving as corridors for spread. Additionally, other management activities that create soil disturbance are also closely associated with roads. For example, landings, staging areas, and livestock handling facilities, are almost always adjacent to roads.

In contrast, most sensitive plant sites are not adjacent to roads. Sensitive plants generally require specific microsites that are generally not in disturbed habitats. Most of the sensitive plant habitat within the treatment areas is currently not infested with invasive plants. The fact that there are only eight known populations of sensitive plants within 100 feet of proposed treatment areas illustrates this point. It is possible that there are additional undiscovered populations of sensitive plants in areas that may be treated during the life of this project. The median distance of mapped invasive plant sites to a road is 4 feet and more than 65 percent of known invasive plant sites are within 25 feet of a road center.

Project design features that restrict herbicide application rates, and require pre-treatment assessments to confirm sensitive species populations, as well as surveys of high potential sensitive plant habitats, and required monitoring would reduce the chances of inadvertent spraying of sensitive plant populations. Additional protection will be provided by project design features that monitor and can change herbicide-use buffers of known sensitive plant sites.

Offsite Movement of Herbicides

Although potential for offsite movement varies among herbicides and their application rate, the amounts transported offsite are likely to be quite small. Some plant species are so highly sensitive to certain herbicides that they may be affected by exposure concentrations 100 to 5,000 times less than the typical application rate. The toxicity of herbicides to terrestrial plants is determined by studies of seed emergence, seed germination, and post-emergence applications, using crop and forage plants.

The probability of non-target plants being affected by soil blown from treated sites is low for all herbicides, despite the risks described in the previous paragraph. Potential for wind erosion in the project area is highest on traveled road surfaces and in large burned areas immediately after a fire. Invasive plants generally do not occur on active road surfaces. While invasive plants do invade burned areas, infestations generally arise over a 10-year period, and are not treated the same season as the fire. None of the known treatment sites is considered to have high risk of wind erosion.

Drift could potentially affect non-target plants adjacent to treatment sites; the risk would be greatest during use of picloram and the sulfonylurea herbicides. Offsite drift is a physical process dependent on application rate, droplet size, and weather conditions. To reduce drift, herbicide labels have advisories for wind velocity and nozzle pressure/droplet size. The presence of intercepting vegetation at application sites can also limit drift. Drift is most associated with broadcast, rather than spot applications. Marrs et al. (1989) examined the distances that drift from broadcast applications affected non-target vascular plants and found observations consistent with drift deposition models. The maximum safe distance at which no lethal effects were found was 20 feet, but for most herbicides, the distance was 7 feet or less. Generally, damage symptoms were found at greater distances than lethal effects, but in most cases, there was rapid

recovery by the end of the growing season. No effects were seen to non-target vascular plants further than 66 feet from the broadcast treatment zone. Damage to non-target plants outside of treated areas from drift has not been observed at sites on the Forest spot treated with glyphosate or picloram in the past.

Project design feature I -4 (table 9) restricts use of herbicides to no closer than 100 feet from known sensitive plant populations, so would greatly reduce the chance of negative impacts from herbicide drift.

Runoff could potentially impact germinating seedlings of non-target plants down slope of treatment sites. GLEAMS modeling indicate damage from runoff is most likely to occur under conditions where picloram, imazapyr, or sulfonylurea herbicides are applied to sites with clay soils right before a thunderstorm. The risk on other soil types is low.

Unintended Direct Spray

Unintended direct spray would result in an exposure level equivalent to the application rate, and is much more likely than wind erosion, drift, or runoff to cause impacts to non-target plants. The potential for damage to non-target plants would be greater during broadcast spraying than during spot spraying or wicking, which are much more selective application methods and generally apply less herbicide per acre. Broadcast applications would be used on dense patches of invasive plants that have few interspersed native species; therefore, it is unlikely that substantial impacts to desirable plants would occur. Spot spraying or wicking could damage plants growing immediately adjacent to or among target invasive plants. Monitoring of past spot applications on other forests has found these techniques to be highly accurate, with most of the visible damage to non-target plants occurring within less than 10 feet of treated plants (Desser Declaration in Case No. CV-10-1397-SI, 2012)

Residual Soil Activity

Many herbicides have residual soil activity. Root uptake by nearby non-target plants could result in their damage or mortality. Some herbicides (especially picloram, aminopyralid, imazapyr, and imazapic) can persist and remain active in soil for two or more seasons. This can prevent germination and establishment of susceptible plants. As noted above, past spot applications of picloram on other forests have not resulted in observable damage to non-target plants outside of the immediate treated area, either from unintended direct spray or from residual soil activity. The main desire is to recover desired plant communities, and picloram could persist to exclude desired forb type vegetation. However, pdfs (see soils section below) eliminate the potential for herbicide persistence in the soil to have long term effects on native plant communities.

Herbicide Effects to Fungi/Soil Organisms

Herbicides have the potential to affect soil and soil organisms, including fungi. Herbicide effects on soil organisms are not well studied. For the proposed herbicides, risk assessments found typical application rates of picloram could inhibit soil microbial activity, although the indirect effect this would have on non-target plants is not known. Existing studies of herbicide effects on formation of mycorrhizal associations in forest and nursery settings indicate little effect (Busse et al. 2004). More information on effects on soil organisms is in chapter 3.4.

There is only one sensitive fungal species suspected to occur on the Malheur National Forest. The umbrella false morel (*Pseudorhizina californica*, formerly known as *Gyromitra californica*) is a fungus that is associated with forest litter, rotting wood and mineral soil. It is found in riparian areas, coniferous forests, and sometimes in old logging skid trails (Aurora 1986). Habitat for this species is most likely in areas that are not highly susceptible to invasive plant infestations (except in log skidding trails). Although the location of the mycelia of these species is not known in many cases, it is unlikely they occur in areas that would be treated by application of herbicides.

Herbicide Effects to Bryophytes and Lichens

Little information is available about how herbicides may affect lichens and bryophytes. Concerns have been raised about drift from some herbicides decreasing the sustainability, relative long-term abundance, and diversity of lichens and bryophytes (Newmaster et al. 1999; R6 2005 FEIS). Lichens and bryophytes lack roots and instead obtain moisture and nutrients directly from the atmosphere; therefore, they are particularly sensitive and vulnerable to aerosols and contaminants in the atmosphere such as herbicide mist. Sensitive bryophyte and lichen species known to occur on the Malheur National Forest are generally found in wetlands, on rock surfaces, and in late-successional forest ecosystems.

Potential Effects to Special Forest Products

The main special forest product that is gathered on the Malheur National Forest is firewood. Posts and poles are another important non-timber product. All proposed treatments for invasive plant species should have no effect to opportunities to gather these products. Any potential negative effect would be human exposure to herbicides. The risks of human exposure to herbicides are discussed in other sections of this document.

There is a chance that plants gathered for food and medicinal purposes may be impacted by invasive species treatments. Mechanical, cultural, and herbicide treatments should only minimally impact these plants. This is due to the relatively small areas of treatment, especially when compared to the amount of habitat for these species. The project design feature that dictates the use of blue dye (pdf F6) and public education about the dye should greatly reduce the risk of human exposure to herbicides when collecting special forest products.

The risk of negative impacts to special forest products is low; therefore, the risk from each alternative is determined to be minimal. No comparison of the alternatives is needed in terms of effects to special forest products. None of the alternatives would result in measurable impacts to special forest products.

Potential Effects to Pollinators

Pollinators can be impacted directly or indirectly by herbicides, possibly resulting in decreased reproduction of some non-target plants. Little information is available on the effects of herbicides on native pollinators, which include a wide variety of invertebrates (beetles, wasps, bees, butterflies, moths), and some vertebrate species. Known quantified effects are from direct spray on the nonnative honeybee. Of the herbicides proposed for use, only glyphosate was shown to have negative impacts to honeybees at the highest application rates. None of the herbicides proposed for use are expected to have toxic effects when used at typical application rates (R6 2005 FEIS). The scale of treatment is so low that any adverse effects would be immeasurable.

Colony Collapse Disorder

Herbicides have a low likelihood of being implicated in CCD. Other pesticides, like miticides, may contribute to conditions that favor CCD. None of the herbicides included in the proposed action or alternatives exceeded toxicity values for honey bees at typical application rates. At highest application rates, only glyphosate caused any mortality, and this necessitated a direct spray at the highest rate. Herbicides are not typically used directly on the agricultural crops that honey bees pollinate because they would have a high likelihood of adversely affecting the agricultural crop (unlike on grass crops where selective herbicides are used on the crop directly). However, herbicides are used near these crops to control invasive plants.

Herbicides used in the action alternatives have a very low probability to cause any affect to honey bees or contribute to CCD because: 1) treatments on the Forest are often in remote locations far from commercial bee hives; 2) treatments in the vicinity of bee hives would only entail treatment of patches of invasive plants and not a widespread application likely to expose honey bees; 3) these herbicides have a low

toxicity to honey bees; 4) affects to bees from these herbicides only occurred for one herbicide at the highest application rate, which is not applied in a spray application (in practice, highest application rates of glyphosate are used in wicking, wiping, or injection applications which are unlikely to expose bees).

Currently, the pathogen *Israeli acute paralysis virus* and the parasite *Nosema ceranae* are the leading candidates for cause of CCD. In addition, recent studies (Cameron et al. 2011) show that the declining species have been reported to have lower genetic diversity and higher infection rates from the pathogen *Nosema bombi* than co-occurring species that are not declining. Causes for the higher susceptibility of declining species are unknown, but current research has not suggested that herbicides are a factor.

Implementation of any of the action alternatives would not have adverse effects on honey bees or contribute to the potential cause(s) of CCD.

Effects on Culturally Significant Plants

Non-herbicide treatment methods are not likely to affect culturally significant plants. Manual methods such as weed pulling allow a great deal of plant specificity and reduce the likelihood of impacts to non-target species. Proposed herbicide treatments have the potential to effect broadleaf varieties and grasses that could potentially include culturally significant plants. Project design features would help prevent impacts to non-target vegetation, including fungi, vascular, and non-vascular plants. Project design features require consultation with affected Tribes as treatments are scheduled, so that tribal members may provide input or be notified prior to gathering culturally significant plants. Individual cultural plants identified by Tribes would be buffered as described for botanical species of conservation concern. The project design feature that dictates the use of blue dye (pdf F6) and public education about the dye would greatly reduce the risk of human exposure to herbicides when collecting culturally significant plants.

Effects of Alternatives

Alternative A

None of the proposed activities would occur under alternative A-no action, thus there would be no direct or indirect effects to botanical resources from invasive plant treatments. Therefore, implementation of the no-action alternative would have no impact (NI) to sensitive plants, and would not lead to any direct negative impacts to culturally significant plants, special forest products, or pollinators.

Since invasive plants often out-compete native plants, the risk to sensitive plants from invasive plants increases with the number of acres of invasive plant infestation. Up to 30,000 acres could be infested over a 15 year period if no treatment occurs and invasive plants spread at a rate of 10 percent per year (see R6 2005 FEIS and ROD and section 3.1.4 for more information on invasive plant spread). Alternative A will not achieve the goal of reducing acreage or suppressing, containing, controlling or eradicating invasive plants. This alternative would not meet the desired future condition “to retain healthy native plant communities that are diverse and resilient, and restore ecosystems that are being damaged, and to provide high quality habitat for native organisms throughout the forest, and assure that invasive plants do not jeopardize the ability of the forest to provide goods and services communities expect.” Invasive species would continue to spread and could eventually adversely impact sensitive species.

Alternative B

Biological control agents must be rigorously tested for host specificity and approved by APHIS prior to release in the United States. The agents proposed for release meet the host-specificity requirements of the R6 2005 ROD Treatment Restoration Standard 14. There is a slight risk that an approved agent could attack a closely related non-target plant species. There are currently no known threats from biological control agents specific to Malheur NF sensitive species. Therefore, no direct effects from the use of biological control agents to sensitive plant species would occur.

Cultural techniques that include seeding and planting native plants may change the species composition at treatment sites. Heavy seeding of native or short-lived nonnative grasses could delay germination and growth of other native plants. However, in areas where competitive seeding may be used, the invasive plant infestations are generally so dense that the native plant community has already been drastically altered. Reducing the invasive plants and establishing desirable vegetation would improve the probability that a native community could reestablish over time. Impurities in seed lots could potentially introduce nonnative or invasive species, but the requirement to use certified weed-free seed would reduce this risk. Project design features that include surveys and buffers for sensitive plants (table 9 pdf Group I) would help to reduce the risk that cultural control methods may negatively impact sensitive plants. Therefore, cultural techniques would not have any direct negative impacts to sensitive plant species or habitat.

The use of herbicides could potentially kill common native and sensitive plants. Alternative B proposes treating up to 2,124 acres per year with herbicides. Common plants near infested areas could be killed; broadcast treatments are the most likely to result in some loss of common native vegetation within 100 feet of target plants. Spot and hand treatments could also kill common plants that are adjacent to treatment sites.

Project design features ensure pre-treatment surveys would be completed for sensitive plant habitat. If any sensitive plants are located during these surveys, pdfs and buffers would be applied to protect the populations of sensitive plants. No treatments are proposed in aquatic habitats, therefore there would be no direct impact to aquatic sensitive plant species.

Alternative B-proposed action would lead to a reduction in the extent and density of invasive plant species in the project area. This would reduce competition and displacement of sensitive plant species over the life of the project. Therefore, the indirect long-term effect of implementation of alternative B would lead to a beneficial impact to sensitive plant species in the project area (BI). The degree of this beneficial impact is directly correlated with how many acres of invasive species are reduced or eliminated.

The sensitive plants survey requirement also provides a large measure of protection for sensitive plant species. However, there is always a small possibility that some populations of sensitive plants may be overlooked during sensitive plant surveys. For this reason, it is not possible to state with 100 percent certainty that all sensitive plant species will be detected during sensitive plant surveys. There is a slight chance that undetected sensitive plant populations may be negatively impacted by proposed treatments. Therefore, the direct effect of alternative B -proposed action on sensitive plant populations and habitat potentially found in treatment areas is, the proposed action may impact individuals or habitat, but will not likely contribute to a trend towards federal listing, or cause a loss of viability to the population or species (MIIH).

Early Detection and Rapid Response (EDRR)

The effects of the EDRR process are the same as the direct and indirect effects because the project design features, annual and life of the project caps, and implementation planning process serve to ensure that future treatments are similar to those analyzed. The requirement that areas proposed for treatment be surveyed for sensitive plants would provide a large measure of protection for sensitive plant species.

Cumulative Effects

In the past, present, and reasonably foreseeable future, there have been and will continue to be projects and activities within the planning area that may cause impacts to sensitive plants and their habitats on the Malheur National Forest. Projects and activities that reduce native plant cover and create ground disturbance increase the risk of invasive plant infestation. Chapter 3.1.5 discusses ongoing activities that

also may be vectors of spread for invasive plants and foreseeable future projects on the Malheur National Forest.

Road construction and recreation developments have permanently removed native plant habitat in parts of the planning area, and disturbed roadsides continue to be a major conduit for invasive plant spread. Public use of National Forest System lands will likely continue to increase with population growth. This will contribute to the spread of invasive plants along roads and in recreation areas.

Historically, people using pack stock brought hay and feed from other areas for their animals. This feed often contained invasive plant species seed. This contributed to the introduction of new invasive species to the area. As part of the R6 2005 ROD, this potential vector of invasive species was reduced by regulations that require the use of certified weed-free feed for all recreational and permitted stock on the Malheur National Forest (Directive R6-2009-001). The cumulative effect of these regulations is there would be fewer introductions of new invasive weed species and new populations of invasive plants in the project area. This would help to reduce the long-term risk to sensitive and other plant species of concern.

Past timber harvest created highly disturbed habitat that has remained open and susceptible to infestation for 25-30 years. Current and planned timber harvest on National Forest System lands in the project area are mostly thinning treatments with the objective of maintaining mature forest and improving forest health. Harvests are often combined with understory fuels treatments. These types of activities are designed to restore habitats to historical stand conditions. Current treatments, when compared to past clear cutting, are less likely to create unnaturally large openings, which leads to more bare ground, which provides good germination sites for invasive species. These vegetation management activities have the potential to increase suitable habitat for invasive plant species.

Domestic livestock grazing is a well-documented vector for invasive species seed transport. Livestock grazing has occurred in most of the project area for decades and has resulted in changes in plant communities, especially in nonforested and riparian areas. Grazing has a direct effect on plants through biomass removal and trampling. Grazing can have an indirect effect on plant species by causing soil compaction, soil disturbance, and alteration of nutrient cycling. The degree of impact to plant species from grazing is related to the timing, duration, and intensity of the grazing action, as well as the individual characteristics and habitat requirements of the plant species. Grazing may reduce the competitive ability of perennial native grasses in rangeland and meadow habitats and creates localized areas of bare ground susceptible to infestation.

The historical abundance and distribution of sensitive species on the Forest is not known. Past activities have likely affected their current abundance and distribution. Beginning in approximately 1990, botanical surveys and biological evaluations were conducted for most Forest Service projects planned and implemented in the project area. These efforts analyzed effects to species included on the Region 6 sensitive plant list at the time of the analysis. As a result, activities conducted, ongoing, and planned since 1990 have been designed to reduce impacts to sensitive species.

Chapter 3.1.5 introduces the basis for the cumulative effects analysis and displays a table lists the past and present vectors of invasive plant spread and reasonably foreseeable future projects within the project area.

Alternative C

Direct and Indirect Effects

The primary difference between alternatives B and C is the amount and types of herbicides used. Alternative C would not allow the use of picloram and would not allow broad spraying. It also would prohibit the use of herbicides within 100 feet of water bodies. The maximum number of acres of herbicide

treatment annually is 735 (as compared with the 2,124 acres proposed in alternative B). The same project design features will apply for sensitive plant protection with additional protection provided near streams.

The effects for alternative C would be very similar as alternative B; however, there will be less use of herbicide and consequently less risk of negative impacts from herbicides relative to alternative B. There would be no herbicide treatments within 100 feet of water bodies, so there would be no risk from herbicides to sensitive plants that occur within 100 feet of water bodies. Although the risk to sensitive plants is relatively lower under alternative C, the same potential sources of risk still apply. The possibility of accidentally treating undiscovered populations of rare plants does exist. Therefore, implementation of alternative C may impact individuals or habitat, but will not likely contribute to a trend towards federal listing, or cause a loss of viability to the population or species (MIIH).

Alternative C would lead to a reduction in the extent and density of invasive plant species in the project area. This would reduce competition and displacement of sensitive plant species over the life of the project. Therefore, the indirect long-term effect of implementation of alternative C would lead to a beneficial impact to sensitive plant species in the project area (BI). The degree of this beneficial impact is directly correlated with how many acres of invasive species that are reduced or eliminated. For this reason, alternative C will not lead to as great of a beneficial impact as alternative B (see chapter 3.1.4 for more information about treatment effectiveness).

Early Detection and Rapid Response

The effects of the EDRR process are the same as the direct and indirect effects because the project design features, annual and life of the project caps, and implementation planning process serve to ensure that future treatments are similar to those analyzed. The requirement that areas proposed for treatment be surveyed for sensitive plants would provide a large measure of protection for sensitive plant species. However, the loss of treatment effectiveness due to fewer acres treated compared to alternative B would be magnified over the life of the project (see chapter 3.1.4).

Cumulative Effects

Cumulative effects for alternative C would be similar as for alternative B. See discussion above.

Alternative D

The difference between alternatives B and D is the first year/first choice herbicides proposed, which indirectly influences the herbicide application method. Alternative D would not allow the use of aminopyralid, which would increase the use of other herbicides, thereby increasing the acreage that would need to be spot or hand treated and changing the herbicide-use buffers required. See chapter 3.1.4 for more discussion of the effectiveness of alternative D vs. alternative B. The maximum number of acres of herbicide treatment annually is 1,654, which is the same as for alternative B. The same project design features will apply for sensitive plant protections.

The risks to sensitive plants from alternative D are similar to alternative B. The same potential sources of risk to sensitive plants apply. The greatest potential risk of negative impacts to sensitive plant species is due to the possibility of accidentally treating undiscovered populations of rare plants. The fact that less broadcasting would likely occur would increase operator control and reduce potential for overspray, drift or accidentally impacting sensitive plants. This would also result in less potential risk to common non-target plants.

Therefore, the direct effect of alternative D on sensitive plant populations and habitat potentially found in treatment areas is that implementation of alternative D may impact individuals or habitat, but will not likely contribute to a trend towards federal listing, or cause a loss of viability to the population or species (MIIH).

Alternative D would lead to a reduction in the extent and density of invasive plant species in the project area, however it would take more time compared to alternative B (see chapter 3.1.4). This would reduce competition and displacement of sensitive plant species over the life of the project. However, indirect long-term effects of implementation of alternative D would lead to a beneficial impact to sensitive plant species in the project area (BI). The degree of this beneficial impact is directly correlated with how many acres of invasive species that are reduced or eliminated. Alternative D is less favorable than alternative B in terms of protecting native plant communities because it is more costly and would take longer to implement.

Early Detection and Rapid Response (EDRR)

The effects of the EDRR process are the same as the direct and indirect effects because the project design features, annual and life of the project caps, and implementation planning process serve to ensure that future treatments are similar to those analyzed. The requirement that areas proposed for treatment be surveyed for sensitive plants would provide a large measure of protection for sensitive plant species. However, the loss of treatment effectiveness compared to alternative B would be magnified over the life of the project (see chapter 3.1.4).

Cumulative Effects

Cumulative effects for alternative D would be similar as for alternative B. See discussion above.

Summary of Effects to Botanical Resources

Table 31. Summary of effects to sensitive plants and special forest products

Issue and Indicator	Alternative A	Alternative B	Alternative C	Alternative D
Type and extent of herbicide use within 100 feet of sensitive plants and special forest products	none	Project design features prohibits broadcast herbicide use within100 feet of sensitive plant populations. Spot applications will be used within 100 feet of sensitive plant populations. Project design feature for use of blue dye will alert special forest product gatherers of herbicide spray areas.	Same as Alt B	Same as Alt B
Effectiveness of buffers and project design features to prevent impacts to non-target vegetation	NA	Buffers and pdfs would substantially reduce the chance of herbicide use within 100 feet of sensitive plant populations.	Same as Alt B	Same as Alt B
Compliance with existing management direction and disclosure of findings	Will not achieve goal of adequately treating invasive plants	Meets full compliance	Meets full compliance	Meets full compliance
Determination of short-term effects to Sensitive Plants	NA	Uncertainties due to difficulty of location and identification of all populations of sensitive plants leads to a call of	Uncertainties due to difficulty of location and identification of all populations of sensitive plants leads	Uncertainties due to difficulty of location and identification of all populations of sensitive plants leads

Issue and Indicator	Alternative A	Alternative B	Alternative C	Alternative D
		may impact individuals or habitat (MIIH). Risk is directly correlated with number of acres treated.	to a call of **may impact individuals or habitat (MIIH).** Risk is directly correlated with acres treated. Slightly lower risk than alternative B due to treating fewer acres with herbicide, and not using picloram (which is more persistent in the soil).	to a call of **may impact individuals or habitat (MIIH).** Risk is directly correlated with acres treated. Slightly higher risk than alternative B due to lower effectiveness of chemicals other than aminopyralid.
Determination of long-term effects to sensitive plants	Spread of invasive plants would lead to a long term negative impact to sensitive plants.	Reduction in amount and extent of invasive plants would lead to a long term beneficial impact to sensitive plants (BI).	Reduction in amount and extent of invasive plants would lead to a long term beneficial impact to sensitive plants (BI).	Reduction in amount and extent of invasive plants would lead to a long term beneficial impact to sensitive plants (BI).

3.4 Soils

3.4.1 Introduction

This section describes the potential direct, indirect and cumulative impacts on soil from proposed invasive plant treatments. Herbicides may accumulate in soils and harm soil biology, nutrient cycling, and the organisms necessary for decomposition and soil productivity. There is also a concern that herbicide treatment on riparian areas would adversely affect water quality and aquatic organisms.

Soils regulate the fate of herbicide through soil properties. The soil litter and medium itself controls the persistence and chance for herbicide to either percolate or runoff to non-target areas. This analysis addresses the fate of herbicide within soils considering the unique environment conditions of the Malheur National Forest and site-specific characteristics. Factors other than taxonomic soil type usually determine the fate of herbicides within the soil, such as of groundcover, compaction, gradient, and biological capacity. Biological capacity is the ability of soil organisms to decompose litter and relates directly to fertility. Higher amounts of organic matter, water, light and favorable temperature affects the ability of soil organisms to process vegetation and herbicide residue.

Regulatory Framework and Compliance

Proposed treatments in all action alternatives would not lead to detrimental soil disturbance, nor substantially add to levels of detrimental disturbance from prior activities. Thus, the Malheur National Forest LRMP standard to retain effective cover would be met. Further, most of the invasive plant treatments occur on administrative use lands where productivity is not the primary purpose. All alternatives would meet Malheur National Forest LRMP objectives (USDA Forest Service 1990, p. 4-21) and regional guidance (USDA Forest Service 1998) for soils.

3.4.2 Affected Environment

Geology

The geology of the Malheur National Forest is amongst the oldest and most complex in Oregon. Remnants of a shallow seafloor and sediments thereon were accreted onto the one-time edge of the North American tectonic plate (Brooks 1979). Under pressure and heat these layers were metamorphosed into argillites, quartzite, amphibolites that predominate in the center of the Malheur National Forest, Aldrich

Mountain, and Bear Valley Basin. This process was concomitant with volcanism, and intrusion of oceanic crust, which are the frequent large bodies of serpentine common to the areas mentioned. A thick sequence of sediment, eroded from the one-time coast range, approximately where the Blue Mountains are today, deposited into the John Day geosyncline. These sediments are the mudstone, shale, graywacke and volcanic rocks that overlay the seafloor sedimentary rocks, but now in turn, are often eroded away to expose the older rock.

Starting about 35 million years ago massive volcanism and attendant uplift resulted in widespread and thick sequence of basalt and andesite lava flows from vents and fissures, interlayered with pyroclastic tuffs, as well as conglomerates and breccia created during erosive periods between bouts of volcanism. Much of the Malheur National Forest is covered by the Clarno, John Day, Strawberry and Columbia Group basalts and andesites (Brown and Thayer, 1966; Greene et al, 1972). These rocks frequently compose the upper ridges and mountain tops, except in the northeast quadrant where uplift and erosion has led to extensive exposure of old seafloor sediments or granitic batholith.

The larger valleys, the John Day, Bear Valley Basin, for example are filled with recent (Holocene) alluvium, but there are also extensive coarse sediment fans of the Pliocene and Pleistocene epoch on lower slopes and bottoms of the larger valleys.

Climate

The climatic conditions that favor invasive plants on the Malheur National Forest were derived by associating current invasive plant sites with annual mean minimum temperature and precipitation from PRISM 30 meter grid data (Daly et al 2008). Mean minimum temperature is a good relative measure of growing season. Most of the invasive plants occur in areas of the forest with a mean minimum temperature above 28 degrees Fahrenheit. Thus the abundance of invasive plant infestations declines substantially above 6000 feet where mean minimum temperatures are less than 28 degrees Fahrenheit and a short growing season becomes a limiting factor (figure 6). In terms of growing season, invasive plants on the Malheur National Forest tend to establish in areas with 54 to 85 frost free days.

Climatic conditions favorable to invasive plants are mostly in the northern and western portions of the Malheur National Forest, and around the 5,000-6,000 foot elevation zone, where greater available moisture and moderate growing temperatures prevail. In contrast, much lower distribution of invasive plant sites occur in the southwestern quarter where the climate is colder and dry.

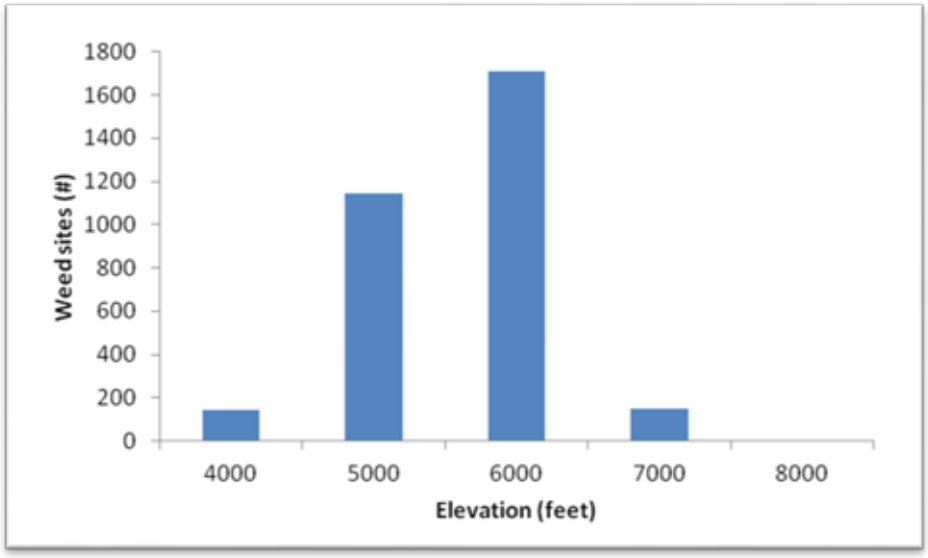

Figure 6. Target invasive plant sites by elevation

Location of Invasive Plants and Soil Conditions

The list of site types in chapter 3 (table 19) shows most the invasive plant sites occupy roadside settings, with natural soil conditions making up a small portion of the current invasive plant sites. Roadside areas provide more available light and less competition for moisture and nutrients, and are frequently disturbed, which favor the typical early seral stage invasive plants. Roadsides have compacted gravels formed for roadbase that may or may not have a developing litter layer where roadside vegetation grows. The soil properties for disturbed roadside environments will be moderate to poor drainage and considered to have low fertility. However, open light conditions and pooled water from roadside drainage increases water availability for grasses and forbs compared to adjacent natural soils.

Natural soils have disturbed conditions from vegetation management, recreation, grazing or wildfire that compacts, bares the surface, but leaves the soil profile in place. The range of natural soils and more importantly the range of soil properties that could influence herbicide movement were derived by overlapping the Soil Survey Geographic Database (SSURGO) Database mapping with invasive plant sites. The mapping however, is complete only for the northern portion of the Malheur National Forest and contains 41 percent of the invasive plant sites. The lack of soil mapping is not necessarily an impediment to analysis since the environmental fate of the herbicides is more related to the level of disturbance than the soil series, and the diversity of soils series within the mapped area is representative of the relevant soil properties across the Malheur National Forest.

The SSURGO mapping has an accuracy of 40 acres for the map units and thus represents a fine scale compared to prior soil surveys. This mapping covers the diverse terrain and landforms common to the rest of the Malheur National Forest. The exception would be that a higher presence of volcanic ash is found in the northern portion of the forest. Table 32 lists soil properties associated with the dominant soil types and affiliated geology derived from the northern portion of the forest.

Table 33 lists the soil properties that contrast soil capacity to hold water and provide nutrients. Soil properties for organic matter, soil depth, hydrologic conductivity, cation exchange capacity and pH were derived from the NRCS Soil Data Viewer. Strong gradients in fertility are found between grassland and forest soils in the project area. Grassland and forb rich soils have high organic matter content along with finer textures that hold water longer into the dry season. The parent rock mineralogy affects the soil texture – degree of clay - rock content, cation exchange content, pH and available minerals. With

exception to the valley bottoms, most of the Malheur National Forest soils have high percent gravel to cobble rock fragments. The pH ranges from 6 to 7, having no indication of acidic or alkaline conditions that limit productivity.

The cation exchange capacity (CEC) serves as an indicator for fertility and adsorption of applied herbicides. The cation exchange capacity is an index of available sites for solutes/ions to attach to soil particles. A higher CEC represents increased ability to hold and release various chemical elements – a relative higher capacity for holding nutrients. The soils in the project area have CEC of 5 to 35 meq/ gram of soil for mineral soil horizons (table 33**)**. Humus, highly decomposed organic matter within the soil, has the strongest impact on overall CEC since humus itself has CEC in the range of 100 to 200 meq. The clay influenced soils have the highest CEC at 35 meq since clay minerals have high surface to volume ratios that bolster CEC. Though not listed in table 33 grasslands with deep accumulations of organic matter will have CEC in the range of 30 to 50 CEC.

The dominant soil series in the northern half of the project area developed on andesite and basalt rocks and range from shallow to very deep soils. These series correlate with 23 percent of the invasive plant sites and comprise the Fivebeaver, Wonder, Bigcow and Rebarrow soil series. Soils derived in these volcanic ash materials generally have silt loam textures, gravelly to stoney conditions and clay contents less than 20 percent. These soils transmit water effectively at 70 to 97 µm/s except for the shallow Fivebeaver series. Higher water availability is found in the Wonder, Bigcow and Rebarrow soils which have higher ash deposition and deeper soil matrix. Available water in these ash influenced basalt and andesite soils has potential 9 to 14 cm; the range for all the mapped soils is 4 to 15 cm. Values below 4 cm indicate low available water.

Tuvame and Mellow soils, the dominant soils with valleys, account for 7 percent of the invasive plant sites. The poor to very poorly drained soils have seasonal water close to the surface, and support various sedge vegetation. These soils have very deep matrix and less rock than the volcanic soil on adjacent hillslopes. Available water in these soils depends on the closeness to the drainage; the loam to silt loam textures support moderate water movement through the soil profile due to lack clay to hold water. The available water is listed 11 cm; however the valley bottom position suggests water could be more abundant.

Soils that have inherently high erodibility include those on steep slopes, developed in volcanic tuff. Btree, Lamulita and Humarel soil series occur on tuff and welded pyroclasic flows, correlated to 6 percent of the invasive plant sites. The duff decomposes easily forming clayey soils. Where deep and well-developed, the soil matrix has a high CEC at 35 meq, not including the forest floor. Because of the finer texture, the water movement through the soil matrix is reduced compared to the andesite and basalt soils at 47 to 69 µm/s. These soils have values of available water similar to the harder rock volcanic soils at 7 to 14 cm, controlled mostly by soil depth.

The metavolcanic soils, which developed on very hard resistant rock, correlate with 4 percent of the invasive plant sites. These include the serpentine derived soils which have inherently poor growing conditions. The dominant soils series include the Lemoncreek and Hondu soil series which have ashy topsoil, and support mixed conifer forests. These rocky soils have less than 14 percent clay, silt loam to sandy loam textures and have low organic matter within the soil matrix. These soils have a low ability to hold water with only 7 cm estimated water.

Granitic derived soils only account for less than 1 percent of the invasive plant sites. Though normally well drained, the ash influence increases water holding capacity on these soils. The Gorhamgulch soil series is the predominant soil type. Soils support mixed conifer forest. The cation exchange capacity is moderate at 15 meq. Available water is high at 15 cm.

Table 32. Most common soil types from SSURGO mapping-sort is from dry to mesic vegetation types

Soil Series	Area (%)	Geology	Characteristic	Vegetation	Where found
Bocker	3.4	Andesite and Basalt	Shallow, mollisol	Sage steppe	Lava plateau
Anatone	2.2	Andesite and Basalt	Shallow, mollisol	Sage steppe	Lava plateau
Fivebeaver	5.0	Andesite and Basalt	Shallow, mollisol	Ponderosa pine and Douglas-fir	Plateaus and backslopes
Wonder	6.9	Andesite and Basalt	Ashy, rocky inceptisol	Mixed conifer forest	Montane ridges and shoulder slopes
Bigcow	6.2	Andesite and Basalt	Ashy, rocky inceptisol	Lodgepole pine and grand fir	Hillslopes
Bennett-creek	4.1	Andesite and Basalt	Thick ash, alfic forest soil	Ponderosa pine and Douglas-fir	Lower hillslopes and footslopes
Deardorf	2.2	Andesite and Basalt	Thick ash,rocky, moist forest soil	Mixed conifer forest	Montane ridges and shoulder slopes
Rebarrow	5.6	Andesite and Basalt	Thick ash,rocky, moist forest soil	Moist grand fir	Mountain valleys
Linecreek	2.2	Basalt	Ashy, rocky alfisol	Ponderosa pine and Douglas-fir	Plateaus, canyons, hills
Olot	2.0	Basalt	Thick ash, rocky forest soil	Mixed conifer forest	Mountains and plateaus
Tovame	4.0	Valley bottom	Somewhat poorly drained, terrace soils	Cinquefoil and sedges	Dry meadows
Melloe	3.2	Valley bottom	Poorly drained, aquic soils within valley alluvium	Alder and sedge	Wet meadows
Btree	2.9	Acidic Tuffs	Thick ash, alfic forest soil on tuff	Mixed conifer forest	Mountains and canyons
Lamulita	1.5	tuff breccia	Clay and rock, ashey, open forest soil on tuff	Grand fir, Douglas-fir, and ponderosa pine	Plateuas and hillslopes
Humarel	2.0	welded pyroclastic flows/ clay rich mafic	Clay and rock, ashey, open forest soil on tuff	Ponderosa pine and Douglas-fir	Hillslopes
Lemon-creek	2.3	Metavolcanics (serpentine)	Ashy, rocky forest soil on metavolcanics	Mixed conifer forest	Hillslopes
Hondu	1.4	argillite and metavolcanics	Deep and rocky, ashy dry forest soil on argillite and metavolcanics	Grand fir, Douglas-fir, and ponderosa pine	Hillslopes
Gorham-gulch	0.5	granite rock	Ashy, forest soil on granite	Mixed conifer forest	Hillslopes

*The percent area found within invasive plant mapping.

Table 33. Soil properties of prevalent soil series

Soil Series	Depth (in)	Dominant Texture	Clay (%)	OM (%)	CEC *	Ksat**	Available Water ***
Bocker	Shallow	cobbly siltloam	22.2	1.5	15	9	3.71
Anatone	Shallow	cobbly siltloam	23.2	1.82	21	9	2.61
Fivebeaver	Shallow	cobbly siltloam	18.4	6.34	21.4	23.56	4.51
Wonder	Very Deep	gravelly siltloam	6.2	16.45	15	97	9.56
Bigcow	Very Deep	gravelly siltloam	6.2	16.45	15	97	9.56
Bennettcreek	Mod Deep	siltloam	6.5	10.67	5	52.68	8.52
Deardorf	Very Deep	stoney siltloam	8.8	10.42	15	69.4	14.42
Rebarrow	Very Deep	siltloam	8.8	10.42	15	69.4	14.42
Linecreek	Mod Deep	extremely cobbly loam	6.5	10.67	5	52.68	10.06
Olot	Mod Deep	stoney siltloam	10.6	11.2	17	69.4	12.73
Tovame	Very Deep	siltloam	9	5.25	15	28	10.95
Melloe	Very Deep	loam	9	5.25	15	28	10.95
Btree	Deep	siltloam	8.8	11.42	15	69.4	14.86
Lamulita	Deep	clay loam	26.8	13.38	32.8	47.4	9.91
Humarel	Mod Deep	very gravelly clay loam	30.8	12.42	35.2	47.4	7.13
Lemoncreek	Mod Deep	siltloam	13.6	4.64	12.7	23.56	7.13
Hondu	Very Deep	sandy loam	6.6	4.78	14.7	25.08	7.14
Gorhamgulch	Very Deep	siltloam over cobbly sandy loam	6.2	11.42	15	52.68	15.08

*Cation exchange capacity in meq/100g for top 10 inches of soil
**Saturated hydrologic conductivity in top 20 inches soil (µm/s)
***Available water holding capacity within top 20 inches soil (cm)

3.4.3 Environmental Consequences

Methodology

The R6 2005 FEIS analyzed herbicide effects to soil organisms and this analysis is incorporated by reference.

Factors other than taxonomic soil type usually determine the fate of herbicides within the soil, such as of groundcover, compaction, gradient, and biological capacity. Biological capacity is the ability of soil organisms to decompose litter and relates directly to fertility. Higher amounts of organic matter, water, light and favorable temperature affects the ability of soil organisms to process vegetation and herbicide residue.

The main consideration for soils is the ability to filter and degrade herbicide residue depending on surface conditions. Site-specific soil and climactic conditions were modeled to examine the depth of percolation of herbicides for typical soil conditions.

Soils were characterized using the Terrestrial Ecosystem Unit Inventory (TEUI) that is currently completed for a third of the Malheur National Forest. Older soils information (Carlson 1974) was used to analyze areas not mapped with the TEUI.

Spatial and Temporal Context for Effects Analysis

Project duration is 5 to 15 years. Repeated treatments, manual, mechanical or chemical may be necessary in sequential years or the same year on the same ground (generally to treat missed plants during initial treatment). All action alternatives may result in repeated treatments through the life of the project. Active restoration may occur to reduce the time necessary after treatment to mitigate the effects of soil disturbance or persistence of various chemical herbicides.

Effects of Alternative A – No Action

Alternative A would not authorize any invasive plant treatments so would not have direct effects on the soil resource. Based on current spread rates (4-12% as per R6 2005 FEIS and ROD), invasive weed populations would continue to grow along the main travel corridors leading to higher risk for spread onto the Malheur National Forest. The effect on soils is a shift away from natural plant and soil communities as invasive plants occupy new sites. Where invasive plants invade newly disturbed sites such as wildland fire areas, the invasive plants can affect the recovery trajectory for desired plant and soil communities

Effects Common to All Action Alternatives

Direct and Indirect Effects Summary

All action alternatives expand the tools for controlling invasive plants. Non-herbicide treatments would have negligible effects to soils. Soils would also not be adversely affected from the herbicide treatments due to the typical rates of application and the prevalence of sites on non-natural surfaces such as road sides, trailways, and at parking areas. Soil productivity would not be directly affected. Indirect effects may include a shift in the composition of plant and soil biota related to use of herbicides. However the project design features applied to all action alternatives make this unlikely because restrictions on the rate, type, and frequency of specific herbicides (see pdf groups F and H, chapter 2, table 9) would reduce herbicide build up in the soil and impacts on soil organisms or productivity.

Direct and Indirect Effects from Non-herbicide Treatments

The non-herbicide treatments would have very minor effects on soils. Some soil disturbance could occur from pulling invasive plants. Typical treatments result in less than 1 square foot loosened soil as pulling is typically used on sparse scattered infestations rather than large, densely infested areas. These disturbances do not adversely affect overall site productive capacity since they are small and distributed, and do not lead to substantial soil loss. The retained cover of target plant species curtails erosion of loosened soil. Bare soils would remain below 10 percent areal extent for a treatment site and restoration (mulching, seeding, planting) would occur as needed (see chapter 2).

Direct and Indirect Effects from Herbicide Treatments

Herbicides would be sprayed directly on target species using ground based methods (hand, spot and broadcast) in all action alternatives; as per the pdfs, all methods, including broadcast would be implemented in a manner that reduces potential for non-target species and bare soil to be affected. Some soil will be directly sprayed by broadcast applications.

Herbicide application temporarily disturbs soils by altering vegetation cover and reducing the annual plant production. The effect is temporary, less than ten years, as desired vegetation returns. The disturbance does not result in detrimental soil disturbance that is an indication for permanent reductions to soil productivity.

The primary consideration for soils is the ability to filter and degrade herbicide residue depending on surface conditions. The major pathway for herbicide degradation is metabolism by soil microbes. Half-lives for herbicides range widely depending on the growing conditions for soil microbes. Herbicide

decays from toxic levels by microbial decomposition, sunlight degradation, and hydrolysis after absorption in the soil profile (Bollag and Liu 1990). Most of the recommended herbicides primarily degrade by microbes metabolizing the residue (SERA 2004b, d, e, 2007, 2011a-d). Chlorsulfuron and metsulfuron methyl also degrade strongly by hydrolysis (SERA 2004a, 2004c).

Indirect effects of herbicide transport to non-target plants and to groundwater resources are influenced by soil properties. Herbicide labels list soil texture as one means to control offsite spread. Herbicide labels have broad applications with agricultural settings having bare soil as a prominent use. For the typical application on Malheur National Forest, plant cover, groundcover, slope steepness and condition of the soil surface factor into the offsite movement in the Malheur National Forest setting. Also, the degree of saturation and compaction contributes to runoff. Leaching corresponds to the position in the valley bottom, porosity of soil material, and rainfall that could transport herbicide residue downward along a wetting front. To the extent that organic matter and productive soils exist, leaching would largely be controlled for in the topsoil as soil microbes metabolize herbicide residue.

The GLEAMS model (see chapter 3.5 for details) was used to examine the fate of herbicides in the rooting zone of the soil and to evaluate the potential for herbicides to run off or leach through soils and reach water bodies. The modeling included a scenario for herbicide application on the most common soil type along a roadside. Figure 7 displays the results by soil depth versus magnitude of herbicide concentration. Dot size represents the level of herbicide concentration (larger dots mean more herbicide found in that soil layer). The Wonder soil series was used, having gravelly silt loam topsoil over gravelly loam subsoil and developed in andesite and basalt parent material to greater than 80 inch depth. Climate data was taken from the nearby Austin station and modeled for summer.

The results of the GLEAMS modeling shows all the herbicides do not penetrate lower than 36 inches using the highest application rates. The faint dot of aminopyralid represents small herbicide concentrations. The sharp decrease in depth illustrates the adsorption of herbicides to soil despite their high solubility. The topsoil organics and mineral matrix bind the bulk of the herbicide in the top inches as reflected in the modeling results.

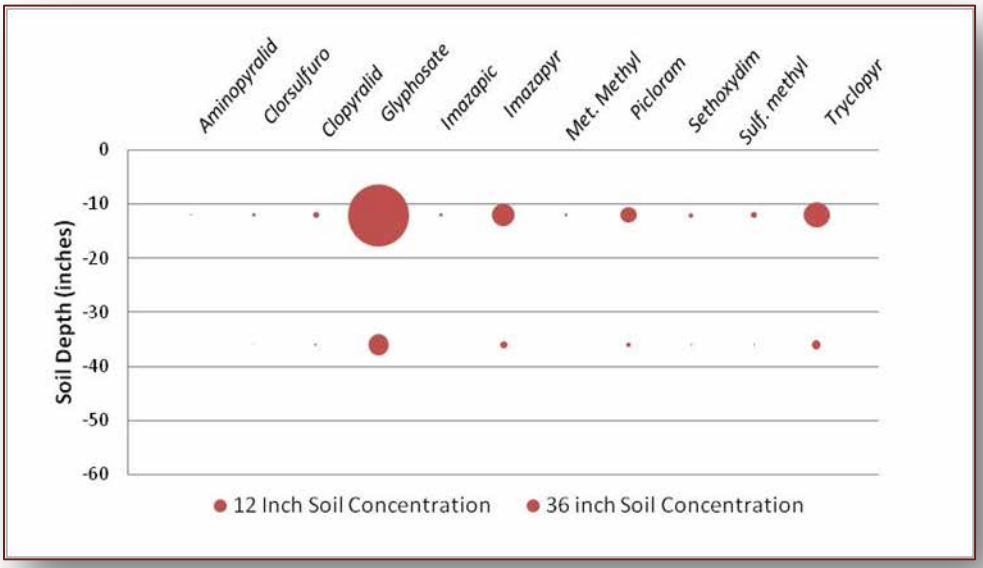

Figure 7. Modeled soil concentrations (ppm) on Wonder Series soils in the Clear Creek watershed

Despite the low risk for offsite transport by water, a risk for offsite transport by dust was identified for the sulfonylurea herbicides where applied to bare soil conditions along roadsides, native surface roads and cleared vegetation areas. Chlorsulfuron, sulfometuron methyl, and metsulfuron methyl binds particularly tightly to clay particles. Risk to non-target plants from herbicide-laden dust was addressed in the risk assessments for these herbicides. To mitigate this risk, these herbicides can only be applied on ashy soil, or light sandy soil during moist conditions (pdf F5). Further, application during calm wind conditions lowers risk for offsite transport (pdf F3).

Direct and Indirect Effects to Soil Organisms

Impacts to soil organisms would be low and transitory due to the type of herbicide, low application rate, and Malheur National Forest climate. The R6 2005 ROD (amended Malheur National Forest LRMP) limited the use of herbicides to those that are unlikely to affect soil productivity and soil organisms. This analysis incorporates by reference the R6 2005 FEIS analysis and findings regarding impacts on soil organisms and productivity.

Impacts to soils and soil microbial community would largely be indirect, related to removal of targeted vegetation and shift to desired plant species. Changes in vegetation type can shift below ground composition of soil organisms (Wardle et al. 2004, Wolf and Klironomos 2005). Indirect boosts in decomposition rates may result as soil microbes metabolize dead plant tissue. Slight increases in microbial activity may occur as the bacteria break down the herbicide. This effect was observed by Ratcliff et al. (2006) where a growth increase in bacteria followed a glyphosate spill; the researchers reasoned that the increase is temporary as the bacteria metabolize the herbicide.

Eight of the 10 herbicides approved in the R6 2005 ROD were not found to pose deleterious effects to soils. Picloram and sulfometuron methyl had potential affects to soil microbes in laboratory tests but not in field studies. These risks were reduced by limiting frequency and rate of application. The project proposes use of sulfometuron methyl at rates half that analyzed in the SERA risk assessment. Picloram use in alternatives B and D has specific design criteria to avoid use on inherently poor soils and limit repeat application (pdf H3 and H4). Picloram would not be used in alternative C.

Aminopyralid may be used in Alternatives B and C. The 2007 SERA Risk Assessment does not indicate any risk to soil microbes.

Using the SERA risk assessments, short term impacts to soil organisms from picloram, imazapyr, metsulfuron methyl, and sulfometuron methyl could occur for high rate applications on poor soils. In laboratory assays, short-term decreases for some types of soil microbes are reported with high concentrations above the amounts expected in soils. The effect of the herbicides decreases with time as other microbes, less sensitive to herbicide, decompose the active ingredient. The project microbial decomposition of each herbicide can be compared in table 37. Persistent herbicides such as picloram have longer half-lives. Impacts to microbes would be least where soils have a high degree of productive capacity with adequate organic matter, aeration and moisture.

For picloram, the SERA risk assessment cited a slight decrease in the N fixing bacteria Azotobactor for a two week period at picloram concentrations of 10 ppm (see Tu 1994). In general, laboratory assays found little detectible changes in microbial activity below 50 ppm soil concentrations (SERA 2011c). Within the SERA risk assessment, GLEAMS model results show that for the clay, loam and sandy soils the soil concentration after application would be below 10 ppm. Results for GLEAMS-Driver modeling on the Malheur National Forest sites for a typical silt loam soil would have 0.3 ppm of picloram following treatment (figure 7). The GLEAMS-Driver is a module that uses climate data specific to an area. Given picloram’s persistence (half-live 80 days to 3 years), this project limits application to once a year (pdf H4). Similarly, picloram is excluded from use on poor soils where natural plant communities are desired

(pdf H3). The emphasis on natural plant community addresses uses on administrative sites and roadsides which have unique conditions that favor desired non-native species as protective groundcover.

For metsulfuron methyl, findings from one study showed slight growth reduction of common soil bacterium above 5 ppm soil concentrations (SERA 2004c). These effects increased with dosage. Modeled metsulfuron soil concentrations are 0.06 ppm. As with picloram, metsulfuron methyl is known to be persistent with half-live of 120 days (see Hydrology section). In agricultural studies, metsulfuron methyl use was linked to damaged rotation or substitution crops from persistence (Yu et al. 2005). The Yu et al. (2005) study demonstrated the detoxifying efficacy of a certain fungus that used metsulfuron methyl as a carbon source. Given the persistence and reliance of microbial degradation, the proposed action is for half the use rate commonly used in USFS applications (see SERA analysis 2004c). The project limits potential buildup of this persistent herbicide by limiting to once per season and avoiding use on poor soils where decomposition rates are low and native vegetation is desired (pdf H3, H4).

Tests for sulfometuron methyl depressing microbial activity showed mixed results from laboratory studies (SERA 2004d). Studies found both no effect and lower microbial biomass using herbicide concentrations near the rates evaluated in the SERA risk assessment. Overall, the risk assessment information was uncertain on the effects to any particular microbial group. Since herbicide half-life indicates the decomposition and thus microbial activity, this provides some indication on the toxicity. Field studies suggest the half-life is at 10 to 100 days (SERA 2004d) with higher decomposition in humid climates (Anderson and Dulka 1985). The half-life range shows ready decomposition by at least some microbial groups.

The proposed application rates for sulfometuron methyl are half of the highest rate used by the SERA risk assessment and modeled soil concentrations less than half that used in the environment fate experiment by Anderson and Dulka (1985). Note, this study showed that soil concentrations of 0.14 ppm followed first order decay equations, suggesting that no depression of microbial activity was found. The proposed level of sulfometuron methyl would have soil concentrations at 0.11 ppm, slightly lower than that used in the study.

The direct effect of herbicides on fungal and bacterial soil microorganisms vary with the herbicide used, and even then depend on the residue reaching the soil and the degradation rate, or half-life of the chemical. The effect to micro-organisms is usually not gauged by direct measurements, but inferred by changes in productivity factors such as respiration (CO2 production), of which microbial activity is one cause (SERA, 2011b). However the measurement of toxicity of herbicides to soil micro-organisms may be relevant only in the soil medium itself. Busse et al. (2001) showed that glyphosate, which can be toxic to microbes grown directly on the herbicide in the laboratory, had an un-measurable effect on microbes when applied directly to soil in the laboratory or in the field. In a follow-up study on glyphosate effects to soil microbial community structure, Ratcliff et al. (2006) showed a sizable increase in the bacteria to fungal ratio for the spill scenario (100% solution) and not for the diluted field rate. The increase may be only temporary as bacteria metabolize the herbicide, a labile carbon source, with an anticipated return to normal composition as the active carbon supply returns to natural levels.

Imazapyr and triclopyr have been shown to temporarily depress microbial activity for select organisms. Imazapyr soil concentrations over 20 ppm were reported to slow cellulose decomposition by microbes in the lab (SERA 2011d). For the Malheur National Forest project, predicted soil concentrations are 0.50 ppm, below the 20 ppm level that effects were found. Triclopyr has reportedly significantly slowed growth of bacterial and fungal strains in laboratory assays where over concentrations exceeded 1000 ppm (SERA 2011a). Some fungal strains had detectible changes to growth down to as little as 0.1 ppm. When testing natural soil samples, no detectible changes to microbial function or community structure was found for a rate of 1.2 lb. a.i./acre (Houston et al. 1998). The typical rate for triclopyr on the Malheur National Forest would be 1 lb./acre. Model runs using a high rate at 2 lb./acre show average soil

concentrations of 0.6 ppm. At this concentration, triclopyr has very low potential for slowing fungal growth.

The capacity for soil microbes to decompose herbicide residue would be greater on natural soils compared to developed environments such as roads, and facility pads. The herbicides have wide-ranging half-lives depending on the biological capacity in the soil. The SERA risk assessment for aminopyralid lists half- lives of 14-343 days (SERA 2007). Since the microbial decay of herbicide is the primary fate, high productivity soils decrease the half- life and thus residency.

Decomposition processes need adequate water supply, air and carbon, which is highest on natural surfaces. Water has been shown the most critical factor for productivity, as microbial activity drops substantially under soil moisture content of ten percent (Davidson et al. 1998). Litter and forest floor layers provide a large proportion of CEC capacity that adsorbs herbicide residue. The litter and forest floor also reduces water losses to evaporation.

Eighty three percent of the currently mapped infested acres occur along roadsides and administrative sites that are non-natural sites. Since these constructed surfaces lack diverse plants and soil microbes, herbicide decay by soil microbes would be reduced. However, herbicides would also decay by photolysis for all selected herbicides. Similar effects would apply to compacted and bared soils such as skidtrails, log landings, off-road parking, and cattle troughs.

Inherently poor soils include shallow, droughty and serpentine soils. These soils have less capacity for decomposition and thus result in longer herbicide residence times. Thin basalt soils are prevalent across the Malheur National Forest, but have high concentrations of organic matter in the topsoil that alleviates concern. Serpentine soils have isolated locations across the forest. The highest density is within in the northern portion of forest which coincides with the fine scale SSURGO mapping. Of the invasive plant sites, twenty sites occur on road templates on or adjacent to serpentine soils comprising 62 acres. Mapped as either Lemoncreek or Cotay soil series, these soils have ash influence that would ameliorate the poor growing conditions associated with serpentine. The Lemoncreek soil has shallow topsoil and thus a higher risk than the Cotay soil series. The infestations have primarily Canada thistle and sulphur cinquefoil. The sites situate in the Mosquito Creek-upper Bear watershed that drains to the Middle Fork John Day River. Most occur within the old Summit Wildfire burn area. Other sites include Little Boulder Creek-Deerhorn and Vinegar Creek subwatersheds of the Middle Fork John Day River.

Where shallow and disturbed soils exist and the desired condition is to restore natural vegetation rather than maintaining vegetation cover and excluding invasive plants, the use of picloram and sulfometuron methyl could reduce potential revegetation. These herbicides persist and poor soil conditions could lengthen already long residency times. The climatic limits, pdfs and herbicide-use buffers minimize the potential for leaching and runoff thereby reducing risk to the extent possible. Picloram application is limited to once per year and excluded on poor soils or shallow soils where productivity may be reduced to the extent that decomposition of the herbicide residue would be stalled (pdfs H3, H4). This effectively reduces the potential for picloram to build up in the soil and have impacts on soil organisms or productivity.

Effects from Early Detection Rapid Response

The current invasive plants sites represent the range of environmental conditions expected on the Malheur National Forest thereby accounting for potential consequences. These conditions were used to analyze and produce project design features that establish a sufficient layer of protection for soil organisms and to limit offsite transport to non-target plants and groundwater.

None of the proposed treatment methods would create large bare areas or result in heavy disturbance to the soil surface. Thus, disturbances would not be large enough to contribute measurable levels of erosion

or sediment delivery to streams. As a result, there is little potential for this project to adversely affect soils or contribute to meaningful cumulative effects when combined with past and ongoing Malheur National Forest activities.

Repeated treatment of herbicides was raised as a concern. The low toxicity and low application rates reduce this risk overall; note that the typical rate would be used in most cases. The eleven herbicides used under this alternative have relatively short half-lives, at less than 3 months where productive soils (table 37). Buildup from repeated uses of picloram and metsulfuron methyl was identified as a concern based on findings from the SERA assessments (SERA 2004d, 2011c). Using these herbicides would have short term transient effects that could slow growth of select soil microbes. These herbicides have half-lives of 90 days and 10-100 days (table 37) depending on soil conditions. The project limits use of metsulfuron methyl to once a year to minimize soil buildup (pdf H4). Since soil conditions determine the buildup potential – a lack of soil microbes equates to lack of decomposition – the use of metsulfuron methyl and picloram would be avoided on sites with poor soil conditions (pdf H3) where restoration to native vegetation is desired. Gravel pits and parking lots would be examples of infertile areas where herbicide buildup would not be a concern.

Cumulative Effects Common to All Action Alternatives

Treatment scenarios would not measurably affect soils or soil productivity when compared with background conditions and ground disturbance created by ongoing activities. Thus, there is no potential for these effects to cause additive, synergistic, or other negative long-term cumulative effects. Manual, mechanical and cultural treatments would likely result in very small disturbances, less than 1 square foot, which would not be large enough to have adverse cumulative effects when combined with past and ongoing Malheur National Forest activities.

Most forest or riparian sites proposed for treatment will have treatment and monitoring of invasive populations extended through the project term (15 years). Foreseeable management activities on these sites are dispersed recreation travel, prescribed burns, wildfire suppression activities, and vegetation management including timber harvest. Although these activities could result in direct detrimental disturbance to the sites, the effects to soils from herbicide applications proposed under this project are unlikely to incrementally change soil characteristics enough to alter the productivity of any treated sites. Activities proposed under this project are not likely to be additive to the impacts of any other activities that could be cumulative to existing conditions on these sites.

The ongoing forest management and recreation activities in addition to natural disturbance from wildfire create the potential for increased use of herbicide and/ or manual treatments. The proposed herbicide spraying assumes a reduction in treatment over time. However, ongoing forest activities may increase the open sites available for invasive plants to spread. The risk is controlled by existing prevention measures. Timber sale contracts have provisions to wash rigs as do fire suppression activities. Similarly, road management has specific contractual agreements that control against invasive plant spread.

The effects of the herbicide treatments do not harm soil organisms but do change the vegetation composition which results in a minor level of disturbance. Ongoing management activities outlined in chapter 3.1.5 create a very large disturbance footprint compared to the effects of any action alternative. A list of forestwide projects are scheduled (2013-2015) that will be concurrent with the action alternatives (table 25). These projects include: prescribed burning, plantation thinning, replacing road culverts, road decommissioning, snow park relocation, aspen release, juniper thinning, toilet replacement, commercial timber harvest, parking lot paving, gate replacement, and demolition of a structure by explosion, fencing and other sundry and related activities. Most of the activities will involve a level of ground disturbance and many will probably risk increasing sediment delivery to streams.

Figure 8 shows the median disturbance acreage for the Malheur National Forest for the past 10 years. High severity disturbance results in detrimental soil conditions that reduce native vegetation cover and impairs soil function. Detrimental disturbance results when management activities physically alter soils and remove organic matter to the extent that soil recovery remains very slow (USDA Forest Service 1998). Low severity disturbance results in short term reductions to vegetation cover that last less than ten years. Invasive plant treatment would not be considered a high severity disturbance. Invasive plant treatment might temporarily slow recovery of native vegetation within some treatment sites, but would eventually help restore desired vegetation.

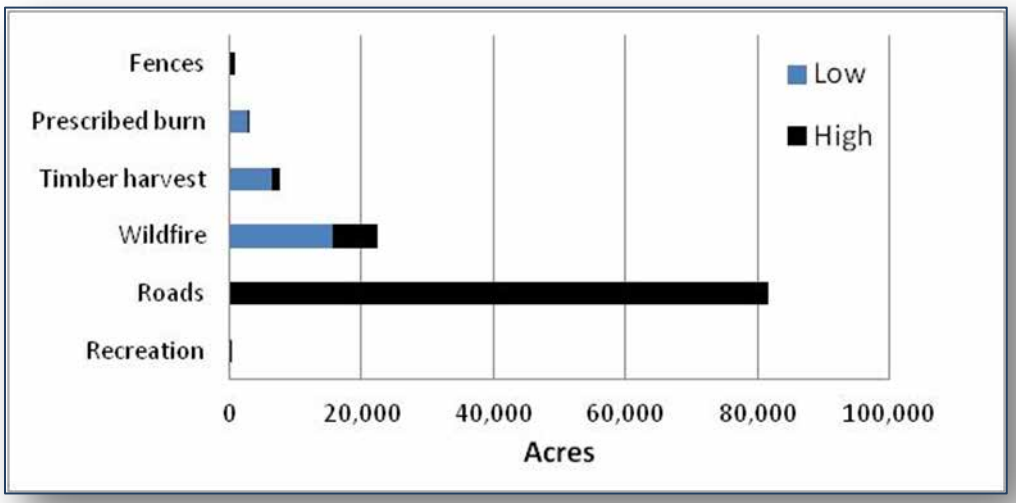

Figure 8. Disturbance from ongoing forest activities

Road-related disturbance accounts for the most extensive disturbance across the forest. Most of the existing invasive plants are mapped along road templates (83 percent). The road templates are not intended as a part of the productive land base and thus minor changes to plant cover from herbicide treatment would not have adverse effects.

Outside of the roads, herbicide application impacts vegetation cover on approximately 85 acres where maintaining a productive land base is the primary purpose. For this area, forest activities or disturbances result from livestock grazing, timber and fuel management, prescribed fire, and wildfire. Herbicide application within areas disturbed by recent activities could temporarily slow the recovery trajectory of native vegetation. The impact would temporarily decrease soil productivity by decreasing overall plant production. Soil productivity would recover as desired vegetation re-establishes.

The short-term reduction in vegetation growth that creates minor soil disturbance is a tradeoff. Given the large disturbance footprint and continued invasive plant presence along the roads, future additive effects from herbicide application and forest activities are reduced if treatment occurs along prominent vectors. The proposed methods reduce populations of invasive plants at rock pits and stockpiled road materials. Using invasive plant-free road materials (i.e., rock and gravel) cuts down the potential spread onto adjoining road prisms and within planned harvest units. Administrative sites, campgrounds, roads—essentially all areas that have unnatural surfaces and perpetual propagule pressure from traffic flow—have the highest risk for cumulative increase in invasive plant spread. These activities correspond to 79 percent of the current invasive plant sites. Since other activities —whether range, timber, or recreation management —largely depend on road access, the extent of the infrastructure represents the net effect of all the Malheur National Forest activities.

The action alternatives reduce the chance for spreading invasive plants from other forest management activities by controlling the level of infestation. The proposed methods reduce populations of invasive plants at rock pits and stockpiled road materials. Insuring weed-free road material cuts down the potential spread onto adjoining road prisms and within planned harvest units. Administrative sites, campgrounds, and roads have unnatural surfaces and perpetual propagule pressure from traffic flow, and therefore have the highest risk for cumulative increase in invasive plant spread. These activities correspond to 79 percent of the current noxious invasive plant sites.

Vegetation management, including timber harvest, may result in a heavy disturbance, although there would be rapid recovery of native vegetation. Currently, the Malheur National Forest harvests roughly 7,583 acres of timber annually using the median value from the last 10 years. However, together with wildfire, only 6 percent of the invasive plant sites correlate with timber harvest and wildfire events.

Livestock grazing requires road access and creates heavy disturbance along fence lines, and around stock ponds and troughs. This disturbance has a small footprint; cattle trails typically have 2- to 4-foot width and stock troughs may have 0.25acres of compacted, barren ground. These features are evenly distributed across thousands of acres, as opposed to confined disturbance that results from timber harvest or wildfire. The distributed nature and seasonal disturbance creates a moderate risk for cumulative effects from livestock grazing. Two percent of the invasive plant sites can be attributed to grazing, while disturbance along fence lines forestwide accounts for 0.3 percent of all known infested areas.

Differences between Alternatives

The differences between alternatives would not substantially change their impact on soils because manual and herbicide treatments of invasive plants are unlikely to affect soil properties or productivity. Properties of soils in the Malheur National Forest limit off-site movement of herbicides through the soil profile. Alternative B utilizes the most aminopyralid and allows the most broadcasting of the alternatives. Alternative C reduces the amount of herbicide used, and excludes use on sites that fall within 100 feet of streams, lakes, ponds and wetlands. This alternative also excludes use of picloram. Thus, the risk for herbicide buildup is reduced in this alternative because so little herbicide is comparatively used and because picloram is eliminated.

Alternative D would use 440 more acres of chlorsulfuron, 725 more acres of glyphosate and 63 more acres of picloram as first-choice herbicides (table 14). However, the pdfs, herbicide-use buffers and project caps ensure there would be no measurable adverse effects to soil from these differences.

3.5 Water Quality

3.5.1 Introduction

This section analyzes the effects to water quality from herbicide and non-herbicide treatment on 2,124 acres where invasive plants have been identified. The Affected Environment section briefly describes the existing conditions of water bodies on the Malheur National Forest, as well as the landscape: geology, climate, soil and stream-flow responses, which are important parameters in the model used to determine the fate of the chemical herbicides or assessing the relative risk to water quality of particular sites.

Results of modeling for water and soil concentration are reported in parts per million (ppm). Sedimentation from manual methods will be analyzed by determining probable affected acres within the scope of major watershed area.

Regulatory Framework and Compliance

All land management activities on National Forest System lands are to be conducted in accordance with Forest Plan standards and guidelines for water quality and other resource protection. Use of Best Management Practices (BMPs) in National Forests is required by the National Forest Management Act (NFMA) and prescribed in the LRMPs. Consequently, all land management activities, must be implemented using BMPs for control of non-point source water pollution (USDA Forest Service 2011).

The anti-degradation EPA policy 40 C.F. R. Section 131.12 states that existing water quality, even when it exceeds required levels for stated beneficial uses will be maintained. Potential effects of the proposed action, either through surface runoff of sediment and chemicals or chemicals entering water bodies through groundwater sources do not constitute a significant degradation of quality or impair existing beneficial uses.

This project would comply with all Oregon water quality standards and requirements set by the Oregon Department of Environmental Quality as well as requirements of Oregon Department of Forestry, Forest Practices Rules EC1194, including herbicide use buffers as appropriate and Oregon Administrative Rules 629-620-000 through 629-6200-0800 rules for mixing chemicals near streams. No 303(d) streams would be adversely affected by the project.

3.5.2 Affected Environment

Climate

The climate of the Malheur National Forest is cold winters and warm summers, total precipitation is modest. Annual averages from operating weather stations in and around the Malheur National Forest range from 21 to 11 inches, at elevations between 3,000 and 4,600 feet (WRCC 2013). Precipitation is distributed across the year, most between the months of October and May as snow, with relatively dry summer months. However, the occurrence of the largest events varies considerably; sometimes occasional summer convective storms bring high intensity rainfall. Figure 9 that follows shows the Austin weather station (elevation 4,200’) for select years. The Austin station is near the headwaters of the Middle Fork John Day River, within the Forest boundary. A thirty-day moving average was added in order to smooth the graph and clearly show seasonal pattern.

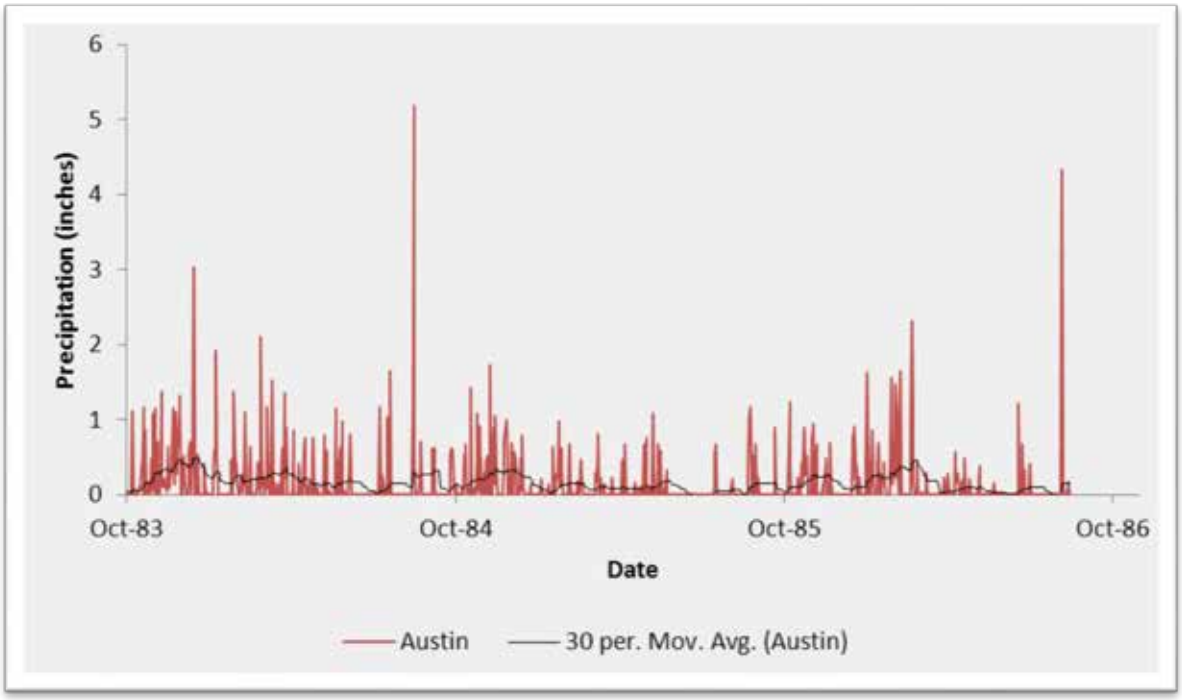

Figure 9. Precipitation pattern at Austin weather station

Stream Flow

There are few gauged streams in the Malheur National Forest, and fewer yet with overlapping records. Two gauges are used here for comparison. The Middle Fork John Day at Ritter (USGS station # 14044000) (USGS 2013) has a drainage area of 515 square miles. The gauge is at an elevation of 2,545 feet. It drains the northeastern portion of the Malheur National Forest. Strawberry Creek (USGS station #14037500) drains 7 square miles of the north flank of Strawberry Mountain. The gauge is at 4,900 feet elevation.

Figure 10 shows mean daily flow for period of record overlap. The patterns of flow are nearly identical, though Strawberry Creek lags by a month or more in peak flow. Both are snowmelt dominated in terms of peak flow and total yield, between the months of March and May for the Middle Fork, and typically June and even early July for Strawberry Creek.

The geology of Strawberry Creek watershed is entirely within the Strawberry Formation, basalt and andesite lava rock. The Middle Fork has a majority of its drainage in volcanic rock of the Strawberry, Columbia River Group or Clarno, but also significant amounts of area in granitics and serpentines and meta-volcanics of the Canyon Mountain Complex. The precipitation record from the John Day weather station is given as well to show the influence of events. Heavy rainfall in the summer or early fall can cause minor peaks in the hydrograph, but the occurrence of annual peak flow and most of flow yield is due to snowmelt runoff in late spring—early summer and is typically regardless of precipitation amount.

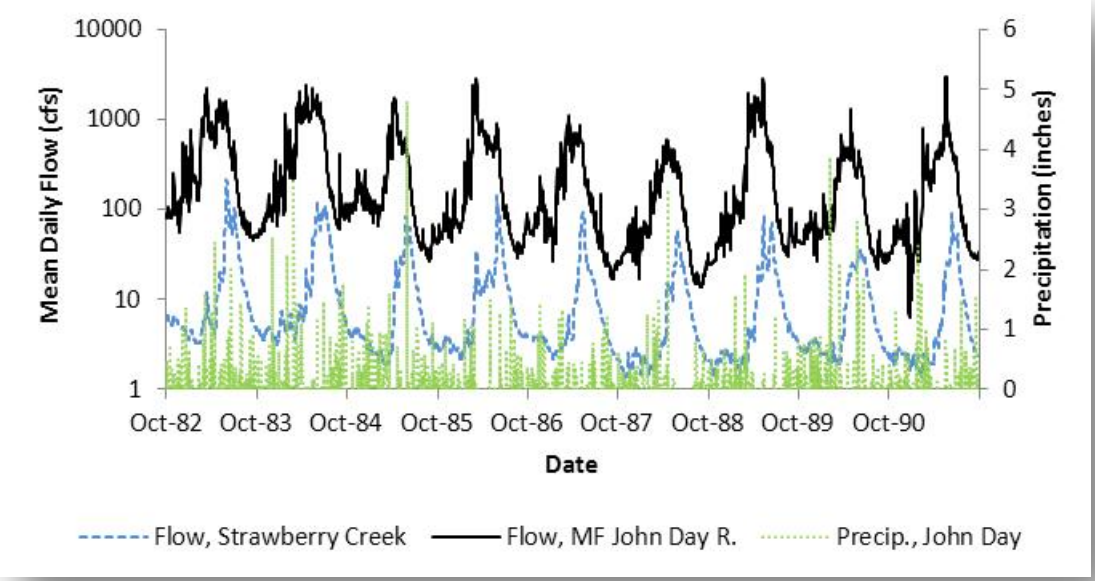

Figure 10. Stream flow at selected gages and precipitation at John Day

Water Quality

The anti-degradation EPA policy 40 C.F. R. Section 131.12 states that existing water quality, even when it exceeds required levels for stated beneficial uses will be maintained. The Malheur National Forest Land and Resource Management Plan stated direction for water quality is to meet state of Oregon standards (IV-2) and comply with state requirements in accordance with the Clean Water Act (IV-39); website: http://www.fs.usda.gov/detail/malheur/landmanagement/?cid=fsbdev3_033814

Use of water quality and other resource protection BMPs (USDA Forest Service 2012) in National Forests is required by the National Forest Management Act (NFMA). Pertinent practices to this project assure proper mixing, application and clean-up as well as evaluation and monitoring of application that guard against use on unintended targets. Project design features, particularly parts F, G and H (see chapter 2, table 9) incorporate BMPs on the handling of chemicals (Section 5, (8—13).

There are 6,220 mapped miles of stream channel on the Malheur National Forest. About 2,788 miles or 45 percent of the total is mapped as perennial, meaning flow is typically sustained beyond the influence of wet season or snowmelt through most of the year.

Section 303(d) of the Clean Water Act (1972) requires that the state list water bodies on biennial basis that do not meet minimum requirements for stated beneficial uses. The State of Oregon Department of Environmental Quality is the responsible agency for assessing and listing impaired streams. As of this writing the 2012 report was not complete. The 2010 list is referenced (http://www.deq.state.or.us/wq/assessment/assessment.htm). Category 5A streams are those listed and needing an EPA approved Total Maximum Daily Load (TMDL) of pollutant allowed to meet water quality standards. Category 4A streams are those that have approved TMDL, and have subsequently been de-listed from the 303(d).

Category 4A streams within the Malheur National Forest boundary are the John Day River System, including the Middle Fork and South Fork and their tributaries with approved TMDL for temperature. Issues are water temperature for life stages of red band and cut throat trout. Category 5A streams are

within the Silvies River system and include Hay, Myrtle and Skull Creeks for water temperature; and within Silver Creek system: Nicoll, Claw, Sawmill, Salt Canyon and Mainstem Silver for water temperature.

Other streams listed yet have insufficient information to determine if streams violate standards insufficient information are the Middle Fork John Day and the following tributaries: Long Creek, Deadwood, and Vinegar for bio-criteria, Long and Summit Creeks for sediment. The Silvies River and following tributaries: Camp, Bear Canyon, Van Aspen Antelope for bio-criteria, and main stem Silvies for dissolved oxygen. Finally the upper John Day River is listed for bio-criteria, dissolved oxygen and sediment.

Table 34. Beneficial uses of major streams on the Malheur National Forest

Category 5A	Category 4A	Insufficient Information		
Temperature	***Temperature***	***Dissolved Oxygen***	***Bio-criteria***	***Sediment***
Silvies R. and Silver Crk.	M. and S. Fk. John Day R. and tributaries	Up. John Day R.; Silvies R.	M. Fk. John Day R. and tributaries (Long, Deadwood and Vinegar crks); Up. John Day R.; Silvies R. and tributaries	Up. John Day R., Long and Summit Cks. on M. Fk. John Day R.

Table 35. Drinking water sources

Site Name	Source	NFS acres in watershed	Comments
Municipal : Streams with Surface Water Intake			
Canyon City	Byram Gulch	610	Flows directly from Strawberry Mountain Wilderness
Prairie City	Dixie Creek	9,300	0.44 acres of infestation, none within 100 feet of stream
Springs with Formal Agreement			
Canyon Creek Meadow	EF Canyon Creek	4,200	0.2 acres of infestation, none within 200 feet of stream
Dixie Campground	Trib. Of Bridge Creek	470	0.23 acres of infestation, but none upstream of campground
Idewild Campground	Devine Canyon	350	About 0.1 acre of infestation within campground, and 1.0 acre along roads on watershed slopes
Magone Lake Campground	Lake Creek	150	0.36 acre of infestation along shore of the lake downstream of campground and none within 100 feet of stream.
Parish Cabin Campground	Bear Creek	14,000	1.5 acre of infestation along roads within watershed. 0.1 acre within 100 feet of stream about 5 miles above campground
Strawberry Campground	Strawberry Creek	2,300	No infestation in watershed.
Trout Farm Campground	Trib. of John Day R.	300	No infestation within watershed
Wells with Formal Agreement			
Big Creek Campground	Big Creek	16,400	7.2 acres of infestation along roads within watershed, about 2 acres within 100 feet of stream
John Day	John Day River	100,000	Unknown
Mount Vernon	John Day River	200,000	
Seneca	Silvies River	123,700	

Site Name	Source	NFS acres in watershed	Comments
Yellowjacket Campground	Yellowjacket Creek	3,700	About 7.7 acres of infestation within watershed, and about 4.7 acres within campground area. About 2.5 acres within 100 feet of stream or reservoir.
Austin House Restaurant	Bridge Creek	11,000	About 1`2.5 acres of infestation, most along Hi-way 26

Invasive Plants Near Roads and Streams

Most mapped invasive plants occur along, or near forest roads. Since roads are preferentially routed up valley bottoms to access ridges, they are built alongside higher order (3rd and 4th) streams which constitute the majority of the Forest's perennial streams. Equipment, humans and livestock travel along the roads is the main avenue for seed distribution, and the disturbed ground immediately adjacent to the road running surfaces are common locations for invasive plants.

About 1,312 acres of invasive plant sites are within about 100 feet (33 meters) of roads within the project area (see site type #2, chapter 3.1.3) when the portion of infested sites that meet the criteria (not the entire site) are considered. This amounts to about 61 percent of total infested acreage.

There is a strong association between forest roads and perennial stream channels. About 2,138 miles of the Malheur National Forest System roads are within about 300 feet (100 meters) of mapped stream courses (34 percent of the total stream mileage).

When only portions of infested sites (not the entire infested acreage in the site) are considered, about 471 acres of mapped weeds are within 100 feet (33 meters) of streams (see site type #7, chapter 3.1.3).

Table 36. Acres of occurrence of invasive plants near roads and streams

Distance of Occurrence	Acres of mapped invasive plants	Percentage of total mapped invasive plants
Within 100 feet of Forest roads	1,321	61
Within 300 feet of Forest roads	1,725	81
Within 100 feet of streams	471	22

Herbicide Use

Herbicides that are highly water soluble or strongly adsorbed to soil particles have the potential to move off site following application. Once into solution herbicides may transport through the soil as groundwater flow, potentially reaching natural surface water bodies. However, as groundwater is dispersed through a soil there is also increasing chance that chemicals will adsorb to the soil. Precipitation events immediately following herbicide application can push herbicide deeper into the soil column (percolation). The depth of herbicide transport is influenced by soil properties, herbicide properties, and amount of precipitation. Given these parameters, the depth of herbicide movement in the soil was estimated using the GLEAMS-Driver model for representative sites.

Runoff risk is particularly high for saturated soils during snowmelt, because of low infiltration capacity. Spraying in spring when soil moisture is high and groundwater flow active may pose greater risk to transport of chemicals than in early fall when soil moisture content is very low, even under the same conditions of precipitation. Increased runoff and percolation can pose increase risk of contaminating surface water. To limit risk of offsite movement of herbicides, pdfs H5 and H6 limit herbicide spraying in conditions of high water table or saturated soils and H11gives parameters on allowable weather conditions for spraying.

The duration or half-life of the herbicide in the soil also influences risk of off-site movement and potential risk to water quality. Percolation that stops in the top few inches of the soil, in the zone of microbial activity, would degrade faster and pose less risk to water quality. Herbicides that percolate deeper tend to degrade more slowly and pose more risk to water quality.

Roadside treatments pose the greatest risk to water contamination from herbicide spraying because roadsides are more compacted and promote more runoff and roadside ditches may have direct connection to a stream channel. In these circumstances ditches may effectively circumvent streamside buffers.

3.5.3 Environmental Consequences

Methodology

Analysis for herbicide effects used published assessments (SERA, 2001, 2004a-d, 2005, 2007, and 2011a-d), which provided parameters of degradation in various mediums, adsorption in soil, solubility in water. These parameters were used in the GLEAMS model (in the risk assessments) and GLEAMS-Driver utility (for site-specific analyses) to assess potential risk of off-site movement of herbicides, potential effects to water quality, and effectiveness of stream buffers. Assumptions are that herbicide application rates would be no more than the maximum rate (see table 18 in chapter 3.1.2). We conducted runs on 4 sites on the Malheur National Forest, using local soil, precipitation, slope, vegetative cover, streamflow. The start date of the model runs was June 15 of any given year. Applications were modeled once a year on that date.

Spatial and Temporal Context for Effects Analysis

Project duration is 5-15 years. Repeated treatments, manual, mechanical or chemical may be necessary in sequential years or the same year on the same ground. There is the potential, under the proposed action that a given site will be impacted for up to 15 years and whatever recovery time necessary after that to mitigate the effects of soil disturbance or persistence of various chemical herbicides. The proposed action also provides for additional treatment of newly invaded sites during the life of the project.

Early Detection Rapid Response (EDRR)

Early Detection Rapid Response (EDRR) is an essential component of the proposed action because the precise location of target plants is subject to change, and new infestations may grow substantially in area during the time taken to prepare new NEPA documents. The highest risk is for spread along infested roadways that provide open sites for weeds and high propagule pressure from passing traffic. The current use of pdfs and buffers would limit offsite effect from runoff, erosion transport and leaching as discussed above for new detections.

Effects of Alternatives

Alternative A – No Action

There are no direct, indirect or cumulative effects of choosing the no-action alternative. See chapter 3.1.5 for more information about the potential for spread of invasive plants over time within the Malheur National Forest. The impacts from invasive plant spread are not expected to impact hydrology or water quality given the types of infestations found within the project area. However, over time, invasive plants could outcompete desirable vegetation that helps maintain functional riparian areas and stream conditions.

Alternative B – Proposed Action

The proposed action would allow spraying of herbicides on up to 2,124 acres per year over the life of the project. Some non-herbicide treatments would occur in combination with herbicide treatments but the first

year/first choice treatment would be aminopyralid, chlorsulfuron and metsulfuron, with non-herbicide follow up as needed.

Non-Herbicide Treatments

Manual methods are hand-pulling or using hand tools. Ground disturbance would occur from drawing up a plant by its roots, or digging sufficiently to leverage roots out. Other treatments, cutting, clipping, mowing and mulching do not incur any disturbance of the ground. There is short-term risk of erosion if a contiguous patch of ground is disturbed sufficiently to initiate surface erosion, such as a road cut bank or fill slope. No impacts to water quality are associated with biological or cultural treatments.

Herbicide Treatment

The following table 37 gives physical and chemical characteristics of the 11 herbicides proposed for use. These characteristics are important in the following discussion of alternatives and analysis based on the GLEAMS model.

Table 37. Herbicides physical/chemical properties

Herbicide	Toxicity to Aquatic Organisms	Adsorption	Water Solubility (ppm)	Degradation Half-Life (days)		
				Soil Microbes	Water and Sunlight	Ground-water
Aminopyralid	low	low	205,000	14-343	0.6	127-447
Clopyralid	low	low	1,000	12-70	8-40	261
Chlorsulfuron	low	low	27,900	120-180	?	37-168
Glyphosate	moderate	strong	12,000	3-130	4-11	50-70
Imazapic	No info	moderate	>2670	25-142	1-2	30
Imazapyr	low	low	11-13,500	210-2154	500 stable in anaerobic conditions	N/A
Metsulfuron methyl	low	low	≈3,000-10,000 pH neutral	30-126	7-8	35 +
Picloram	low	low	200-400,000	18-300 in aerobic conditions; stable in anaerobic	2.6	14 aerobic; stable in anaerobic conditions
Sethoxydim	low	low	4700 @pH7	1-60 the high end of range is anaerobic conditions	5-43	155+@ pH7
Sulfometuron methyl	low	low	300 @ pH7	10-100	20-60	44-113
Triclopyr TEA	Inhibits fungal and bacterial growth	low	8,100	14-46	2-6 **hours**	6 **hours**
Triclopyr (BEE)	high	strong	2-23	0.2-40	0.5-8.7 Depending on pH	≈6

*--Values in parts per million (ppm)

Herbicides would be sprayed or wicked on leaves and stems of target plants or cut stumps. Herbicide that falls onto the soil could travel offsite by surface runoff or groundwater flow.

Once in soil, herbicide not directly absorbed into plant roots is typically metabolized by microbes (Bollag and Liu 1990) with the exception of Triclopyr, which is degraded by hydrolysis. Hydrolysis is the process by which the water molecule breaks down a compound into at least two separate constituents. Half-life of herbicides in soil is affected by its rate of adsorption to soil particles or organic matter incorporated into the soil. The stronger the adsorption the more likely chemicals will be retained in top soil layers for microbial degradation. Organic matter in particular has an affinity for adsorption.

Degradation proceeds rapidly in presence of sunlight, or by soil microbes when soil moisture is ample. Soil moisture of less than 10 percent becomes a limiting factor in microbial activity (Davidson 1998). Outside these environments—on the soil surface or within the top few inches of the soil where microbial activity is high—the half-life of herbicides is measured in months. All but one of the herbicides is relatively highly soluble and therefore will readily transport deep into a soil column with percolating water. The notable exception is triclopyr BEE which disassociates through hydrolysis very quickly to triclopyr TEA, which has moderately high solubility.

Surface Runoff

Resistance to surface flow on most natural surfaces is amply provided by vegetation and litter cover. Most Forest soils have very low runoff potential if undisturbed. Rainfall intensity only rarely exceeds infiltration capacity of intact soils with cover.

It is unlikely that whole surfaces of treated areas would be made barren by herbicide treatment. In some cases, treated dead invasive plants would provide a dead organic cover on the soil. By the same token manual grubbing and hand pulling of invasive plants would leave the uprooted vegetation on the ground. pdf H3 (table 9) avoids spray treatment on extensive bare areas or obviously poor surface conditions. In the event of surface runoff from a treated area winnowing of sediment laden sheet flow can be as much as 90 percent effective by a vegetative buffer of 100 feet in width, even on steep slopes (Castelle et al. 1994, Castelle and Johnson 2000, Fischer and Fischinich 2004)

Treatment on roads does pose a greater risk to eventual surface water contamination because surface runoff from bare and or compacted surfaces within the road prism shed precipitation water more readily and frequently than natural slopes. In a study at Lake Tahoe, Grismer and Hogan (2005) showed runoff from bare road cut slopes have 10 to 50 times the runoff of similar intact native soils. Further and possibly more significant, road prism runoff from running surfaces and cut banks is often facilitated with engineered ditches and relief pipes. To the extent that drainage may lead onto natural slopes, road surface runoff may be buffered. However, road segments that cross streams or penetrate into stream buffers provide routes for contaminants to reach streams, whether from rutted running surface, roadside ditches or runoff projected onto natural slopes an inadequate distance from the channel for proper buffering.

Surface sheet flow can carry fine grain soil particles of the order of silts and clays (less than 0.0625 mm in diameter). Despite high solubility in water of the herbicides, the typical herbicide molecule has a very large mass and some attraction to negatively charge soil particles means that transport in water is only likely to occur when attached to soil particles that may be moved by shallow sheet flow.

Results from modeling are shown in table 38 and include a treatment along roads. These results agree well with monitoring results from applications on roads in Oregon’s Willamette Valley by the Oregon Department of Transportation (Berg 2004).

Soil Water (Interstitial) Transport

Ten of the 11 proposed herbicides are highly soluble in water with solubility greater than 300 mg/l (Bautista and Bulkin 2008). Once into solution, herbicides may transport through the soil as groundwater flow, potentially reaching natural surface water bodies. However, another possibility remains; as groundwater is dispersed through a soil there is also increasing chance that chemicals will adsorb to the soil. The depth of a wetting front for precipitation events following herbicide application marks the probable depth of penetration of chemicals and an accumulation zone from additional applications of herbicides.

Direct foliar application lowers offsite effects for leaching. If rainfall were to occur during application or within the first day after, the risk for leaching exists for all the herbicides. Project design feature H11 (table 9) lowers leaching risk by avoiding treatment within 24 hours of forecasted rainfall.

Runoff risk is particularly high for saturated soils during snowmelt, because of low infiltration capacity. Herbicide application of highly soluble chemicals is avoided during snowmelt when soils are likely to be saturated (table 9, pdf H5, H6).

Spraying in spring when soil moisture is high and groundwater flow active may pose greater risk to transport of chemicals than in early fall when soil moisture content is very low, even under the same conditions of precipitation. Chemicals move into the soil with infiltrating precipitation, but depth of initial movement is important. A contaminated wetting front that stops in the top few inches of the soil, in the zone of microbial activity, would degrade faster. Herbicides infiltrating into soil with high water content and active gravity flow may quickly percolate beyond the range of most soil biota that would reduce the chemical. Herbicide half-life (the time it takes half the chemical to degrade), increases sharply when in groundwater. Project design feature H10 (table 9) safeguards against spraying under conditions of active infiltration or obvious saturated conditions, when herbicides most easily are transported deep into the soil column.

The Groundwater Loading Effect of Agricultural Management Systems (GLEAMS) model (Website: http://www.tifton.uga.edu/sewrl/Gleams/gleams_y2k_update.htm), is used to examine the fate of herbicides in the rooting zone of the soil. It may be modified for site specific parameters of climate, soils, topography, vegetation cover and size and flow rate of natural water bodies and application rate of herbicides. We chose these sites because they represent the most sensitive of the known sites for water quality. Three of the four sites were adjacent to streams with flow rates varying by an order of magnitude. Two of the steams are mapped as bull trout spawning and rearing reaches.

Table 38. GLEAMS model runs results. All values in ppm.

Dominant soil series/map location	Soil series/ Texture	General Surface Condition	Herbicide Suite	Conc. In Soil (12”)	Conc. In Soil (36”)	Peak Conc. In Water**
Site#1 Invasive: sulphur cinquefoil First choice: metsulfuron methyl Location: T12S R31E S18, Road: maintenance Level 2 Road # 4110 HUC6: Beech Stream name: Ennis Creek	Humarel soil series Very gravelly clay loam, very cobbly clay, moderately deep, 31 inches	Native surface road in conifer forest with fair grass cover, high runoff potential, poor surface condition Treatment area: 2800 feet long, 50 feet wide centered on road, 0-100 feet	aminopyralid	0.036	0.0000	0.00
			chlorsulfuron	0.0965	0.0000	0.0001
			clopyralid	0.1169	0.0000	0.0000
			glyphosate	1.3141	0.0000	0.0001
			imazapic	0.0687	0.0000	0.0002
			imazapyr	0.4026	0.0000	0.0011

Dominant soil series/map location	Soil series/ Texture	General Surface Condition	Herbicide Suite	Conc. In Soil (12”)	Conc. In Soil (36”)	Peak Conc. In Water**
Model Run design flow 2cfs		from stream. Hill slope gradient 20%	metsulfuron	0.0582	0.0000	0.0000
			picloram	0.3477	0.0000	0.0001
			sethoxydim	0.0975	0.0000	0.0003
			sulfometuron	0.0816	0.0000	0.0001
			triclopyr*	0.5517	0.0000	0.0005
Site# 2 Invasive: Canada thistle First Choice: Aminopyralid Location: T10S R34E S35 Road: Maintenance Level 2 Road #7106 HUC6: Camp Creek Stream name: unnamed Model Run design flow 2cfs	Five Beaver soil series gravelly silt loam/extremely cobbly silt loam, shallow depth, 14 inches	Native surface road in conifer forest with fair grass cover, high runoff potential, poor surface condition Treatment area 1800 feet long 50 feet wide centered on road, 350 to 700 feet from stream. Hill slope gradient 27%	aminopyralid	0.0372	0.0000	0.0004
			chlorsulfron	0.0832	0.0000	0.0000
			clopyralid	0.1402	0.0000	0.0018
			glyphosate	1.3524	0.0000	0.0000
			imazapic	0.0709	0.0000	0.0001
			imazapyr	0.04965	0.0000	0.0008
			metsulfuron	0.0599	0.0000	0.0000
			picloram	0.0356	0.0000	0.0003
			sethoxydim	0.1007	0.0000	0.0002
			sulfometuron	0.1122	0.0000	0.0002
			triclopyr*	0.5659	0.0000	0.0003
Site#3 Invasive: St. Johnswort First choice: aminopyralid Location: T10S R34E S32, HUC6: Camp Creek Stream name: Granite Boulder Creek, bull trout spawning/rearing Model Run design flow 10cfs	Melloe soil series Loam/very cobbly sandy clay loam, very deep, 79 inches	Conifer forest, excellent grass, moderate runoff potential Treatment area: 350 feet X 500 feet along Granite Boulder Creek and below Road 4611 Hill slope 3%	aminopyralid	0.03445	0.0124	0.0000
			chlorsulfron	0.0355	0.0119	0.0000
			clopyralid	0.1304	0.0475	0.0000
			glyphosate	1.3117	0.4373	0.0000
			imazapic	0.0691	0.0230	0.0000
			imazapyr	0.4854	0.1619	0.0000
			metsulfuron	0.0579	0.0195	0.0000
			picloram	0.3440	0.1174	0.0000
			sethoxydim	0.0978	0.0326	0.0000

Dominant soil series/map location	Soil series/ Texture	General Surface Condition	Herbicide Suite	Conc. In Soil (12”)	Conc. In Soil (36”)	Peak Conc. In Water**
			sulfometuron	0.1091	0.0364	0.0000
			triclopyr*	0.5520	0.1843	0.0000
Site#4 Invasive: houndstongue First choice: chlorsulfron Location: T11S R35E S34, Road: maintenance Level 2 Road # 2255 HUC6: Clear Creek Stream name: Clear Creek/bull trout spawning—rearing Model Run design flow 2cfs	Wonder soil series, Gravelly silt loam/gravelly loam, very deep, 79 inches	Native surface road in conifer forest with fair grass cover, high runoff potential, poor surface condition Treatment area 1,180 feet long and 50 feet wide centered on road, 180 to 250 feet from stream	aminopyralid	0.0372	0.0128	0.0000
			chlorsulfuron	0.0834	0.0279	0.0000
			clopyralid	0.1406	0.0490	0.0000
			glyphosate	1.3525	0.4508	0.0000
			imazapic	0.0.071	0.0.0237	0.0000
			imazapyr	0.4977	0.1659	0.0002
			metsulfuron	0.0600	0.0201	0.0000
			picloram	0.3601	0.1208	0.0001
			sethoxydim	0.1010	0.0337	0.0001
			sulfometuron	0.1126	0.0375	0.0001
			triclopyr*	0.5676	0.1893	0.0002

*--GLEAMS does not model for ester form triclopyr BEE, only for Triclopyr TEA.

Results of GLEAMS runs are shown in table 38 on selected sites. The location of the selected sites is displayed in figure 11. We modeled the results of using any of the 11 herbicides at these sites, however, only the first-choice herbicide and other effective herbicides described in table 8 would likely be used, unless a new target species were to occupy these sites and need treatment under our EDRR proposal.

None of the predicted peak concentrations in water exceeds drinking water standards as defined by the state of Oregon (State of Oregon 2004). Ninety-one different contaminants currently have concentration standards including glyphosate (0.7mg/l limit), picloram (0.5 mg/l) and pentachlorophenol the active ingredient in clopyralid (0.001 mg/l). In all cases predicted water concentrations are 3 to 4 orders of magnitude lower than for the chemicals with stated thresholds

None of the concentrations are of a magnitude that would likely trigger listing as a 303d stream. Beneficial uses of streams flowing from the Malheur National Forest are to which impairments are evaluated and thereby inclusion on the state 303(d) list are aquatic life, or cool water aquatic life (State of Oregon 2010 integrated 303(d0 and 305(b) report:http://www.deq.state.or.us/wq/assessment/2010Report.htm). Peak water concentrations predicted are far below the levels of concern for fish (see Fisheries report; EIS chapter 3.6) by several orders of magnitude. Herbicide spraying largely avoids riparian areas, and in the case of riparian application is not of the extent to affect riparian vegetation that shade water and maintain water temperatures. First,

application within riparian zones would be direct to stems of invasive plants, and second, large woody species of the type that provide significant shade would be unaffected.

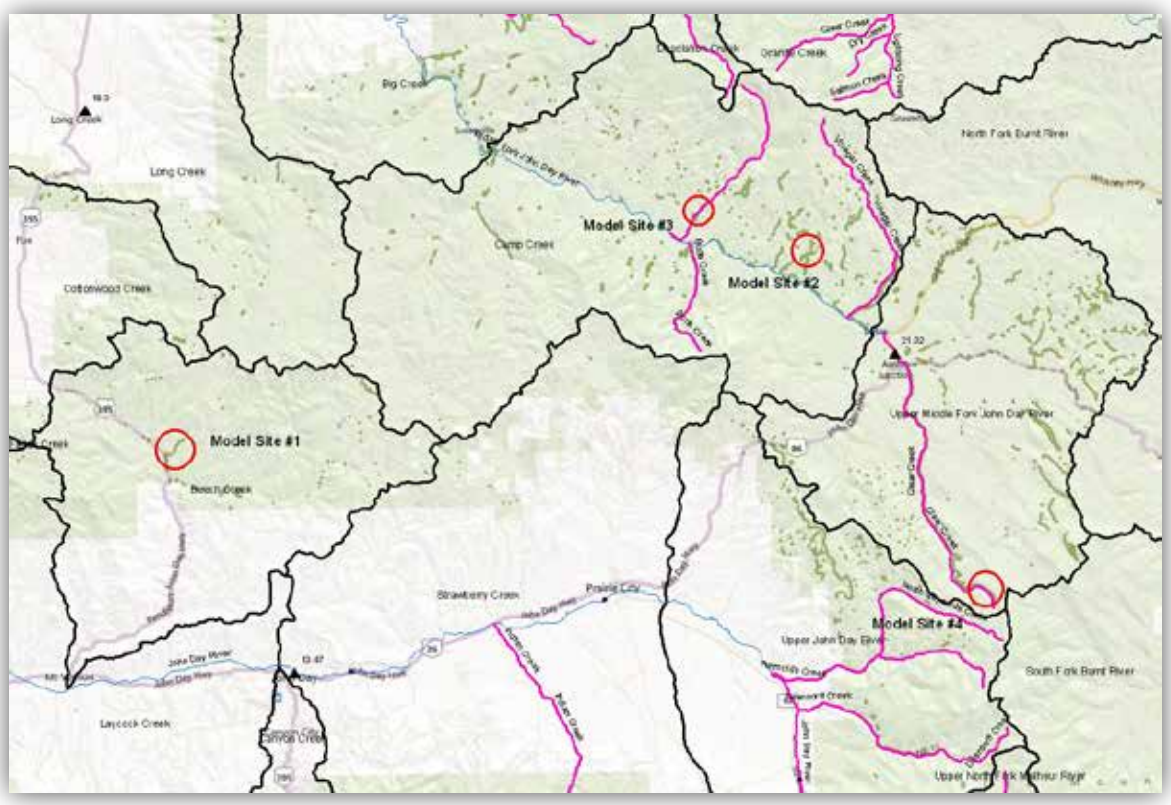

Figure 11. Location in Middle Fork John Day River of GLEAMS model sites

Purple shaded streams are bull trout spawning and rearing; green shading is invasive plants sites

In soil and water the conversion of triclopyr BEE and TEA to triclopyr acid is rapid. Both BEE and TEA hydrolyze quickly in natural water. Microbial degradation also degrades triclopyr in water. Once TEA and TBEE convert to triclopyr, there is little toxicological hazard to aquatic organisms and triclopyr does not bio-accumulate to a great extent (Ganapathy 1997).

Effectiveness of Buffers

Bakke (2001) in a review of monitoring results after herbicide spraying on Eldorado and Stanislaus National Forests found that buffers of greater than 20 feet were completely effective in eliminating Glyphosate and Triclopyr in detectable levels (about 0.5 parts per billion) in adjacent streams. Slight but detectable levels (0.5-2.4) were found when buffer widths were 10-15 feet for Glyphosate on the Stanislaus National Forest.

Berg (2004) in a comprehensive review of Best Management Practices associated with herbicide spraying in region 5 and elsewhere in the United States found similar results. Detectable levels of herbicides such as Glyphosate, Triclopyr and Clopyralid were found in various locations (Washington, Oregon, New York and Florida) mainly as a result of drift from boom broadcast spray or aerial application. An Oregon Department of Transportation study sampled runoff from road shoulders after treatment of Glyphosate, with no buffers on a stream. Under simulated rainfall of high intensity they found 100’s of ppb could be transported off site. In a similar test, under natural rainfall 0.1-1 ppb was detected leaving the road prism.

The results of these studies show that the GLEAMS results for this project are reasonable, and that the greatest risk is from roads with direct hydrologic connection to stream channels

Cumulative Effects

Depths of maximum concentration presented in GLEAMS results are between 8 and 12 inches (table 38). Although the application of herbicide is likely in successive years on most sites, the time between applications and the half-life of the various herbicides will minimize residue accumulations. Applying herbicides at typical and not maximum recommended rates will limit the amount of excess residue present on site each year, while the presence of soil microbes and soil temperatures conducive to degrading the herbicides will limit the amount of accumulation.

A list of forestwide projects are scheduled (2013-2015) that will be concurrent with the proposed action (table 25). There is no other use of herbicide, although most of the activities will involve a level of ground disturbance and many will probably risk increasing sediment delivery to streams. However, since the amount of sediment that would reach streams in alternative B is so low, there would be no potential for cumulative effects to sediment delivery.

Invasive plants are throughout the Malheur National Forest but concentrated in the Middle Fork John Day drainage. Half-life period, solubility or adsorption of each herbicide determines how readily each will transport off site. The greatest risk to water contamination is the possibility of transport of residue herbicide on roads that have direct connection to a stream channel. In these circumstances engineered drainage features may circumvent buffers. Herbicide half-life period and pdf that limit re-treatments of more persistent herbicides largely precludes cumulative effects from multiple treatments at a single site.

The result of the GLEAMS model runs on various scenarios of sites within the project area is consistent results of several monitoring studies reviewed by Bakke (2001) and Berg (2004). Amounts of herbicides in streams are predicted to be below levels of concern for aquatic health. Effect of manual treatment on water quality is slight to unmeasureable (R6 FEIS 2005 Appendix J) and adverse impacts would be minimal in this alternative.

Alternative C

Alternative C would have no herbicide use within 100 feet of a stream channel. While table 39 shows that under no modeled scenario do the peak water concentration approach the levels of concern for aquatic organisms, providing for increased buffer would further reduce effects. GLEAMS model was run for the most soluble and/or most toxic of the suite of chemicals that are proposed, for 100 foot buffer sites on Granite Boulder Creek and Ennis Creek. These results are given below in table 39.

Table 39. GLEAMS model results for alternative C

Dominant soil series/map location	Soil series/ Texture	General Surface Condition	Herbicide Suite	Conc. In Soil (12”)	Conc. In Soil (36”)	Peak Conc. In Water**
Site#1 HUC6: Beech Stream name: Ennis Creek	Humarel soil series	Treated area condition: native surface road in conifer forest with fair grass cover, high runoff potential, poor surface condition Stream buffer 100 feet wide, good grass cover, good soil condition	aminopyralid	0.0000	0.0000	0.0000
			clopyralid	0.0000	0.0000	0.0000
			imazapyr	0.00.29	0.0000	0.0000
			picloram	0.0000	0.0000	0.0001
			triclopyr*	0.0013	0.0000	0.0000

Dominant soil series/map location	Soil series/ Texture	General Surface Condition	Herbicide Suite	Conc. In Soil (12”)	Conc. In Soil (36”)	Peak Conc. In Water**
Site# 2 HUC6: Camp Creek Stream name: unnamed	Fivebeaver soil series	Treated area condition: native surface road in conifer forest with fair grass cover, high runoff potential, poor surface condition; Stream buffer 100 feet wide, good grass cover, good soil condition	aminopyralid	0.0000	0.0000	0.0000
			clopyralid	0.0001	0.0000	0.0000
			imazapyr	0.0027	0.0000	0.0000
			picloram	0.0002	0.0000	0.0000
			triclopyr*	0.001	0.0000	0.0000

All values in ppm

Table 39 above shows that the peak water concentration are measurably lower within the buffer than out (compare to table 38) but that in any case peak water concentrations remain far below any levels of concern for aquatic organisms (table 39).

The Water Erosion Prediction Program (WEPP) (Elliot 2004) was used to assess, quantitatively the impact of increased manual grubbing of invasive plants on sediment delivery. WEPP has a disturbed forest slope, and a forest road application, so that manual grubbing and a typical forest road may be compared for amount of sediment produced on a unit area basis of an acre. The Austin weather station was used, as with the GLEAMS model. The following parameters were used for inputs into WEPP for the Malheur National Forest road application: 0.5 percent grade, 14 feet wide, in-sloped but not ditched with medium traffic for equivalent area of treated ground produced over 2 tons of sediment a year on an acre basis compared to less than 2 pounds for a natural hill slope treated by manual grubbing, which assumed about 40 percent remnant cover, but otherwise in good condition, i.e. non-compacted or rutted.

To take this to a broader scope Camp Creek HUC 5 which contains two of the GLEAMS modeled site has 677 acres of mapped invasive plants or 31 percent of the total, and also 127 acres of mapped invasive acres within 100 feet of a stream channel, 27 percent of the total. Within the Camp Creek watershed is 150 miles of roads, of which 22.5 miles is within 100 feet of a stream, or approximately 38 acres of running surface which equals 78 tons of sediment per year versus 0.06 tons from manual treatment. The road surfaces are contributing sediment every year though rates will vary widely according to slope and drainage. The above calculations are assuming that every acre of invasive plants in the stream proximity will be 100 percent treated.

There would be slight decreases in water concentration of chemicals due to use of wider stream buffers, but as with alternative B these levels are barely at detectable levels and far below levels of concern for aquatic organisms. There is the potential for increase in sediment delivered to streams because of manual treatment within the buffers however this level of activity is well below current delivery rates and likely not at measurable levels in streams which contain known aquatic resources.

Cumulative Effects

As with alternative B there are no other activities that use herbicides on the Malheur National Forest, and water concentrations of chemicals under alternative C would be below measured levels of concern. The increased potential for sediment delivery to channels is still far below current levels associated with roads and ground disturbing activities on a yearly basis and below detectable levels.

Alternative D

Direct and Indirect Effects

Effects of alternative D would be similar to alternative B, except an LRMP amendment would not be completed and aminopyralid would not be approved for use on the Malheur National Forest. Aminopyralid would not be used to treat known sites or new detections. Compared to alternative B, more picloram, clopyralid, and glyphosate would likely be used in lieu of aminopyralid. Herbicide treatment could be up to 2,124 acres per year under this alternative.

Glyphosate has high water solubility, but also has very strong adsorption qualities, and in the GLEAMS model runs never penetrated beyond 8 inches into the soil. It also has a moderately higher toxicity to aquatic organisms than the other chemicals being considered here; however never in the model runs, because of adsorption rate, registered detectable limits of concentration in water. Model runs assume high maximum application rates of 7 pounds per acre. It is not expected that wider use of glyphosate due to selection of this alternative would lead to water concentrations higher than the model results.

Picloram also has very high water solubility and low adsorption rate to soil, so the chemical has a high ability to transport with groundwater, and is very stable under anaerobic conditions. Otherwise it has average or even low persistence in research studies. Still, its toxicity to fish and invertebrates is relatively high, and because of it transportability and persistence in sediments (where anaerobic conditions might prevail), in general use, it poses one of the greatest environmental risks of the entire suite of chemicals being proposed.

Clopyralid has moderately low solubility and soil absorption rate. Toxicity to aquatic organisms is also low with LC50 concentrations many orders of magnitude above modeled runs. Clopyralid has however high resistance to degradation, particularly in absence of sunlight, nonetheless it is not expected that increased use of clopyralid will pose greater risk than model results imply.

Cumulative Effects

As with alternative B there are no other activities that use herbicides on the Malheur National Forest, and water concentrations of chemicals under alternative D, would be below measured levels of concern. The potential for sediment delivery to channels would also be very similar to alternative B, which is far below current levels associated with roads and ground disturbing activities, and below detectable levels.

3.6 Fisheries

3.6.1 Introduction

Fish species of special conservation concern (e.g., federally listed, USFS sensitive, USFS management indicator species) within the aquatic environment analyzed in this report include the native bull trout, middle Columbia River steelhead, middle Columbia River Chinook salmon (including essential fish habitat), redband (rainbow) trout, and westslope cutthroat trout (table 40). In addition, one USFS sensitive aquatic macroinvertebrates and one amphibian species are addressed. All aquatic species of special conservation concern (and their habitat) will be analyzed for both effects to individuals and effects to habitat.

During public scoping, concerns were raised about the use of herbicides near streams or other surface water that may result in herbicide concentrations in water that are harmful to fish (particularly ESA listed fish and native fish) and other aquatic organisms. Manual and mechanical treatments can also impact water quality, fish, and other aquatic species by disturbing riparian structure or increasing sedimentation. This report estimates effects to aquatic species and their habitat from herbicide and non-herbicide treatment methods.

Detailed analyses of federally listed fish species are provided in the project fisheries biological assessment (for preferred alternative only). Similarly, USFS sensitive aquatic species are analyzed in the project biological evaluation (for all EIS action alternatives).

PACFISH and INFISH are programmatic strategies to help maintain and restore aquatic habitats on the Malheur National Forest and other Forests east of the Cascade Mountains. Riparian Management Objectives (RMOs) are identified in these strategies and Forest projects are designed to contribute to meeting these objectives, or at least not block attainment of RMOs. Our progress toward maintaining and restoring good fish habitat is measured at the 3rd to 6th order streams scale, based on measurable indicators of good fish habitat.

The indicators are pool frequency, water temperature, amount of large woody debris, lower bank angle of the creek, and width to depth ratio. These indicators are addressed through the matrix of pathways and indicators discussed for fish species.

Treatments authorized under this invasive plant treatment project could be implemented as part of aquatic habitat restoration activities on the Forest. The long term intent is to restore native plant communities to the extent possible. However, treatments near the aquatic environment have the potential for short-term adverse impacts. In general, these adverse impacts are very small in comparison to the beneficial impact of the restoration.

Regulatory Framework

The Executive Order 12962 of 1995 (aquatic systems and recreational fisheries) requires federal agencies to conserve, restore, and enhance aquatic systems to provide for increased recreational fishing opportunities nationwide. The Order requires federal agencies to evaluate the effects of federally funded actions on aquatic systems and document those effects relative to the purpose of this order.

The two principle laws relevant to fisheries management are the National Forest Management Act of 1976 (NFMA) and the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 et seq.). Direction relative to fisheries is as follows:

- NFMA requires the Forest Service to manage fish and wildlife habitat to maintain viable populations of all native and desirable non-native wildlife species and conserve all listed threatened or endangered species populations (36CFR219.19).
- ESA requires the Forest Service to manage for the recovery of threatened and endangered species and the ecosystems upon which they depend. Forests are required to consult with the U.S. Fish and Wildlife Service (USFWS) or the National Marine Fisheries Service (NMFS) if a proposed activity may affect the population or habitat of a listed species.

The Malheur National Forest Land and Resource Management Plan (LRMP) as amended (USDA Forest Service 1990), provides direction to protect and manage resources. The specialist report cites a detailed list of the portions of the Forest LRMP relevant to fisheries and fisheries habitat requirements. In addition Forest standards and guidelines along with relevant laws are cited. Of special interest are Forest LRMP amendment 29 and PACFISH/INFISH (1995). Recommendations regarding fisheries habitat would adhere to this regulatory framework.

Fish-bearing streams, are assigned 600-foot wide (total width) riparian habitat conservation areas (RHCAs), as defined within PACFISH/INFISH. RHCA widths along other streams in the Project Area vary depending on whether streamflow is perennial or intermittent. Treatment within RHCAs is generally more restrictive than that within terrestrial habitat types.

Key Watersheds: The intent of designating Key Watersheds is to provide a pattern of protection across the landscape where habitat for fish species of special conservation concern would receive increased attention and treatment. Priority within these watersheds would be to protect, or restore habitat for listed stocks, stocks of special interest or concern, or salmonid assemblages of critical value for productivity or biodiversity. Criteria considered to designate Key Watersheds are:

1. Watersheds with stocks listed pursuant to the ESA, or stocks identified in the 1991 American Fisheries Society report as "at risk" or subsequent scientific stock status reviews; or

2. Watersheds that contain excellent habitat for mixed salmonid assemblages; or

3. Degraded watersheds with a high restoration potential

Threatened and endangered species are listed under the ESA; whereas, sensitive species are identified by the Forest Service Regional Forester. An endangered species is an animal or plant species that is in danger of extinction throughout all or a significant portion of its range. A threatened species is an animal or plant species that is likely to become endangered within the foreseeable future throughout all or a significant portion of its range. A sensitive species is an animal or plant species for which species viability is a concern either a) because of current or predicted downward trend in population numbers or density, or b) because of current or predicted downward trends in habitat capability that would reduce a species' existing distribution. Forest Plan Standard 62 (p. IV-32) gives direction to meet all legal and biological requirements for the conservation of threatened and endangered plants and animals.

Standard 62 states, "Assess all proposed projects that involve habitat changes or disturbance and have the potential to alter the habitat of threatened, endangered or sensitive plant and animal species."

When threatened or endangered species or habitats are present, follow the required biological assessment process, according to the requirements of the ESA (Public Law 93-205). Forest Plan Standard 64 further states, "Meet all consultation requirements with the USFWS and state agencies." Effects to aquatic threatened, endangered, and sensitive species are analyzed in the Aquatic Biological Assessment/Evaluation located in the Project Record.

The Magnuson-Stevens Fishery Conservation and Management Act (MSA), as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), requires the inclusion of Chinook salmon Essential Fish Habitat (EFH) descriptions in Federal fishery management plans. In addition, the MSA requires Federal agencies to consult with NMFS on activities that may adversely affect EFH.

Management Indicator Species (MIS) are species of vertebrates and invertebrates whose population changes are believed to best indicate the effects of land management activities. Through the MIS concept, the total number of species found within the Forest is analyzed using a subset of species that collectively represent habitats, species, and associated management concerns. The MIS are used to assess the maintenance of populations (the ability of a population to sustain itself naturally) and biological diversity (which includes genetic diversity, species diversity, and habitat diversity), and to assess effects on species in public demand. Forest Plan Standard 61 (p. IV-32) lists species and gives direction to provide for habitat requirements of MIS species. Aquatic MIS on the Forest include: rainbow/redband trout, bull trout and steelhead trout.

3.6.2 Affected Environment

Aquatic Species of Conservation Concern

Table 40 describes aquatic species of conservation concern on the Malheur National Forest. It includes the status of each species, whether it is documented or suspected to occur on the Forest, and other specific information about the populations that could be affected by forest activities.

Table 40. Aquatic species of conservation concern

Species	Status	Occurrence	Note
Middle Columbia River steelhead (*Oncorhynchus mykiss*)	Federally threatened, designated critical habitat	Documented occurrence	Middle Columbia River distinct population segment (DPS)
Bull trout (*Salvelinus confluentus*)	Federally threatened, designated critical habitat	Documented occurrence	John Day and Malheur species management units (SMUs)
Middle Columbia River Chinook salmon (*Oncorhynchus tshawytscha*)	Essential fish habitat and USFS sensitive	Documented occurrence	Essential fish habitat (EFH)
Redband trout (*Oncorhynchus mykiss gairdneri*)	USFS sensitive*	Documented occurrence	Widespread
Westslope cutthroat trout (*Oncorhynchus clarkia lewisi*)	USFS sensitive*	Documented occurrence	Present in John Day River and tributaries
Western ridged mussel (*Gonidea angulata*)	USFS sensitive*	Documented occurrence	Only known in Middle Fork John Day River

*From 2011 Region 6 list.

Steelhead

Steelhead (Middle Columbia DPS, MCR steelhead) was listed by NMFS as threatened under the Federal Endangered Species Act (ESA) on March 25, 1999 (64 FR 15417). Middle Colombia River steelhead are also a Malheur National Forest management indicator species (MIS). Critical habitat for MCR steelhead was designated on September 2, 2005 (70 FR 52630).

Life History (NatureServe 2013): Migrates between freshwater breeding and marine nonbreeding habitats. steelhead typically spend 2 years in fresh water, migrate to marine waters where they spend 2-3 years, then return to natal stream to spawn. Most middle Columbia River steelhead smolt at 2 years and spend 1-2 years in salt water prior to re-entering fresh water, where they remain up to a year before spawning. First-time spawners generally are 4-5 years old. Individuals are capable of spawning more than once before they die, though spawning more than twice is rare. Steelhead eggs incubate 1.5-4 months before hatching (varies with temperature). Juveniles spend 1-4 (generally 2) years in fresh water before migrating to the ocean as smolt.

Steelhead are capable of surviving in a wide range of temperature conditions. They do best where dissolved oxygen concentration is at least 7 ppm. In streams, deep low velocity pools are important wintering habitats. Freshwater habitat types utilized include: big and medium rivers, creeks, low to high gradient, pools, and riffles. Usually requires a gravel stream riffle for successful spawning. Eggs are laid in gravel in a depression made by the female. Salinity of 8 ppt is the upper limit for normal development of eggs and alevins.

John Day River Status (ODFW 2009): The John Day River Major Population Group (MPG) covers Oregon's John Day River drainage. The MPG contains five extant populations (Lower Mainstem John Day, North Fork John Day, Middle Fork John Day, South Fork John Day and Upper Mainstem John Day). Steelhead in these populations are exclusively summer steelhead. The MPG is one of the few remaining summer steelhead groups in the Interior Columbia basin that has had no intentional influence from introduced hatchery steelhead and that has recently been classified as strong or healthy. Spawning is widely distributed across tributary and mainstem habitats.

The Lower Mainstem John Day River population includes tributaries to the John Day River downstream of the South Fork John Day River. This widespread population is the most differentiated ecologically from other populations, occupying the lower, drier, Columbia Plateau ecoregion. The North Fork John Day River population occupies the highest elevation, wettest area in the John Day basin. Population boundaries include the main stem and tributaries of the North Fork John Day River. The population was defined based on habitat characteristics, basin topography, and demographic patterns. The Middle Fork John Day River population resides in the Middle Fork John Day and all its tributaries. Spawning areas in the Middle Fork John Day River are separated substantially from all other spawning areas; except for those in the North Fork John Day, that exhibit different habitat characteristics.

Table 41. Special Status Fish in John Day River Watersheds

Watershed	Population Current Risk Status
North Fork John Day	Highly viable
Upper Mainstem John Day	Moderate risk
Lower Mainstem John Day	Moderate risk
Middle Fork John Day	Moderate risk
South Fork John Day	Moderate risk

The following are major limiting factors for the John Day River MPG:

Main limiting factors and threats:

- Degraded tributary habitat
- Mainstem passage
- Hatchery related effects
- Predation/competition/disease in mainstem and estuary

Within the analysis area, there are approximately 409 miles of designated critical habitat, dispersed throughout 15 watersheds (table 40). A detailed biological assessment (BA) will be prepared for the preferred alternative and ESA Section 7 Consultation with the National Marine Fisheries Service (NMFS) is underway.

Bull Trout

Bull trout were listed by the USFWS as threatened under the Federal ESA on June 10, 1998 (63 FR 31647). Critical habitat for bull trout was not designated in the analysis area by the USFWS (70 FR 56212). Bull trout are also a Malheur National Forest MIS.

The analysis area includes portions of both the John Day and Malheur bull trout species management units (SMUs).

Life History (USDI 2002): Bull trout have more specific habitat requirements than most other salmonid. Habitat components that influence bull trout distribution and abundance include water temperature, cover, channel form and stability, substrate for spawning and rearing, and migratory corridors. Bull trout are found in colder streams and require colder water than most other salmonid for incubation, juvenile rearing, and spawning. Spawning and rearing areas are often associated with cold-water springs, groundwater infiltration, and/or the coldest streams in a watershed. Throughout their lives, bull trout require complex forms of cover, including large woody debris, undercut banks, boulders, and pools. Alterations in channel form and reductions in channel stability result in habitat degradation and reduced survival of bull trout eggs and juveniles. Channel alterations may reduce the abundance and quality of side channels, stream margins, and pools, which are areas bull trout frequently inhabit. For spawning and early rearing bull trout require loose, clean gravel relatively free of fine sediments. Because bull trout have a relatively long incubation and development period within spawning gravel (greater than 200 days), transport of bedload in unstable channels may kill young bull trout. Bull trout use migratory corridors to move from spawning and rearing habitats to foraging and overwintering habitats and back. Different habitats provide bull trout with diverse resources, and migratory corridors allow local populations to connect, which may increase the potential for gene flow and support or refounding of populations.

Declines in bull trout distribution and abundance are the results of combined effects of the following: habitat degradation and fragmentation, the blockage of migratory corridors, poor water quality, angler harvest and poaching, entrainment (process by which aquatic organisms are pulled through a diversion structure or other device) into diversion channels and dams, and introduced nonnative species. Specific land and water management activities that continue to depress bull trout populations and degrade habitat include dams and other diversion structures, forest management practices, livestock grazing, agriculture, road construction and maintenance, mining, and urban and rural development. Some threats to bull trout are the continuing effects of past land management activities.

Bull trout are present within both the Malheur River and John Day River drainages. Occupied waters within the John Day River drainage include: headwaters of the North Fork John Day River, Middle Fork John Day River, and upper mainstem John Day River and tributaries, with seasonal use of the mainstem river downstream to the vicinity of the town of John Day. The John Day River Recovery Unit Team has identified 12 extant local populations in the recovery unit. Within the Malheur River drainage occupied areas include: North Fork Malheur River and the Upper Malheur River sub-basins, and the Mainstem Malheur River from headwaters downstream to Namorf Dam.

Within the analysis area there are approximately 202 miles of designated critical habitat, dispersed throughout 6 watersheds within the John Day River and Malheur River drainages.

Redband Trout

Redband trout are currently on the Region 6 USFS sensitive species list, and are also considered a MIS species on the Malheur National Forest.

Life History: This is a resident form of rainbow trout, and exhibits habitat preferences similar to those for steelhead (described above). Redband trout may migrate within river systems, but do not migrate to the ocean. Redband trout populations are widely distributed in all/most major stream drainages (and tributaries) within the Malheur National Forest, including the John Day River, Malheur River, and Silvies River (table 42).

Westslope Cutthroat Trout

Westslope cutthroat trout are currently on the Region 6 USFS sensitive species list, and are also considered a MIS species on the Malheur National Forest.

Life History (NatureServe 2013): Habitat includes small mountain streams, main rivers, and large natural lakes; requires cool, clean, well-oxygenated water; in rivers, adults prefer large pools and slow velocity areas (stream reaches with numerous pools and some form of cover generally have the highest fish densities); often occurs near shore in lakes. Juveniles of migratory populations may spend 1-4 years in their natal streams, and then move (usually in spring or early summer, and/or in fall in some systems) to a main river or lake where they remain until they spawn. Many fry disperse downstream after emergence. Juveniles tend to overwinter in interstitial spaces in the substrate. Larger individuals congregate in pools in winter.

Spawns in small tributary streams on clean gravel substrate; mean water depth is 17-20 cm and mean water velocity is 0.3-0.4 m/sec; tends to spawn in natal stream. Adfluvial populations live in large lakes in the upper Columbia drainage and spawn in lake tributaries. Fluvial populations live and grow in rivers and spawn in tributaries. Resident populations complete the entire life history in tributaries. All three life-history forms may occur in a single basin. Migrants may spawn in the lower reaches of the same streams used by resident fishes. Maturing adfluvial fishes move into the vicinity of tributaries in fall and winter and remain there until they begin to migrate upstream in spring. Of migratory spawners, some remain in tributaries during summer months but most return to the main river or lake soon after spawning

Westslope cutthroat trout distribution is not precisely known, but is known to occur within the North Fork John Day River and upper mainstem John Day River (widely distributed)

Chinook salmon

Spring Chinook salmon are a Region 6 sensitive species. Essential Fish Habitat (EFH) for spring Chinook salmon has been designated by NMFS in the analysis area.

Life History (USDA 2008a): Salmon are sensitive to changes in water quality and habitat. Juvenile Chinook salmon are generally associated with pool habitats. An increase in sediment lowers spawning success and reduces the quantity and quality of pool and interstitial habitat. Other important habitat features include healthy riparian vegetation, undercut banks and large woody debris.

Adult spring Chinook salmon return to the main stem John Day River and Middle Fork John Day River during the spring. Spawning occurs within both drainages, with the majority in the Middle Fork John Day. Adults hold in deep pools during the summer while sexually maturing. Spawning occurs during fall, generally from August through September. Embryos incubate over the winter and emergence occurs the following spring. Juveniles generally rear for one year in freshwater. Juveniles use habitats with slower water velocities (pools, glides, and side channels). Juveniles overwinter in deep pools with abundant cover. Smoltification and emigration to the ocean occurs in the spring of their second year. The ocean rearing phase lasts from 1 to 3 years.

For this analysis, Essential Fish Habitat (EFH) for Chinook salmon is approximated by the distribution of steelhead, which includes most perennial streams within the John Day River drainage. Consultation with the National Marine Fisheries Service (NMFS) will be conducted.

Western ridged mussel (Jepsen et al. 2010)

The western ridged mussel (*Gonidea angulata*) is widely distributed from southern British Columbia to southern California, and can be found east to Idaho and Nevada. *G. angulata* inhabits cold creeks and streams from low to mid-elevations. Hardhead, Pit sculpin and Tule perch are documented fish hosts for *G. angulata* in northern California, although little is known about the fish species that serve as hosts for this mussel throughout other parts of its range. *G. angulata* is sedentary as an adult and probably lives for 20-30 years, and thus can be an important indicator of habitat quality. *G. angulata* is a filter feeder that consumes plankton and other suspended solids, nutrients and contaminants from the water column. The

large beds of *G. angulata* can improve water quality by reducing turbidity and controlling nutrient levels. Some Native American tribes historically harvested this animal and used it for food, tools and adornment. Populations of *G. angulata* have likely been extirpated in central and southern California, and it has probably declined in abundance in numerous watersheds, including the Columbia and Snake River watersheds in Washington and Oregon. The western ridged mussel belongs to a monotypic genus and thus would be considered a high priority for conservation. Lack of information on the western ridged mussel's current and historical abundance and distribution, and a lack of understanding of which host fish species it uses will impede conservation efforts.

Western ridged mussels have been documented in the Middle Fork John Day River drainage.

Please note that conclusions from the analysis for fishes will be used to qualitatively estimate effects for invertebrates since the aquatic species utilize the same habitat, and detailed distribution and habitat requirements are not well known for the invertebrates.

The following table displays fish species of aquatic concern within 5th field watersheds on the Malheur National Forest. The table shows the acreage infested within each 5th field watershed, and how much of the near-stream area (generally within 100 feet of streams and other water bodies) is currently infested in each watershed on National Forest System land; total infested acres is approximately 462 acres, with 117 of these acres located within 25 feet of streams. The order of the watersheds is in descending order of the percent (on Forest System lands only) of total near-stream area with mapped infestations. This table underscores the fact that most of the 5th field watersheds have scattered infestations that occupy a very small percentage of the near-stream area. Of the 39 5th-field watersheds on the Malheur National Forest, 33 have less than one-half of 1 percent of the near-stream area occupied by invasive plants.

Table 42. Invasive Plants and Fish Species in 5th field watersheds

Watershed Name	HUC 5 code	Infested acres	Percent of total near-stream area	Fish species*
Upper Middle Fork John Day River	1707020301	94.21	**1.50**	BT, CH, ST, RT
Pine Creek	1705011603	31.01	1.45	RT
Big Creek	1707020303	49.8	1.04	BT, CH, ST, RT
Middle South Fork John Day River	1707020103	27.62	.96	CH, ST, RT, WT
Camp Creek	1707020302	94.96	.69	BT, CH, ST, RT
North Basin	1712000101	15.97	.51	RT
Beech Creek	1707020109	21.43	.48	CH, ST, RT, WT
Upper Malheur River-Griffin Creek	1705011605	1.64	.43	RT
Upper South Fork John Day River	1707020101	18.20	.43	RT
Upper Silvies River	1712000201	19.63	.39	RT
Wolf Creek	1705011602	13.97	.33	RT
Little Malheur River	1705011612	4.88	.22	RT
Trout Creek	1712000203	19.86	.39	RT
Otis Creek	1705011606	2.15	.22	RT
Silvies Canyon	1712000205	4.97	.16	RT
Emigrant Creek	1712000206	9.79	.11	RT

Watershed Name	HUC 5 code	Infested acres	Percent of total near-stream area	Fish species*
Bear Creek	1712000202	1.47	.05	RT
Canyon Creek	1707020107	3.66	.05	CH, ST, RT, WT
Fields Creek	1707020111	1.52	.04	CH, ST, RT, WT
Cottonwood Creek	1707020209	3.84	.13	CH, ST, RT, WT
Upper Silver Creek	1712000403	.48	.02	RT
Upper North Fork Malheur River	1705011611	6.55	.10	BT, RT
Long Creek	1707020304	.64	.02	CH, ST, RT, WT
Upper John Day River	1707020106	4.69	.13	BT, CH, ST, RT, WT
Laycock Creek	1707020110	.87	.03	CH, ST, RT, WT
Lower North Fork John Day River	1707020210	.17	.00	CH, ST, RT, WT
Murderers Creek	1707020104	1.30	.02	CH, ST, RT, WT
Upper Malheur River	1705011601	6.50	.09	BT, RT
Strawberry Creek	1707020108	.44	.01	BT, CH, ST, RT, WT
Buck Creek	1707030303	0.00	0.00%	RT
Claw Creek	1712000402	0.00	0.00%	RT
Desolation Creek	1707020204	0.00	0.00%	RT
Granite Creek	1707020202	0.00	0.00%	RT
Grindstone Creek	1707030306	0.00	0.00%	RT
Headwaters Silver Creek	1712000401	.17	0.00%	RT
Lower South Fork John Day River	1707020105	0.00	0.00%	CH, ST, RT, WT
South Fork Beaver Creek	1707030307	0.00	0.00%	RT
Twelvemile Creek	1707030305	0.00	0.00%	RT
Willow Creek	1712000207	0.00	0.00%	RT
		Total: 462		

** Estimate of potential presence: BT = bull trout, CH = Chinook salmon, RT – redband trout, ST = steelhead trout, WT = westslope cutthroat trout*

3.6.3 Environmental Consequences

Analysis Methodology

The fisheries analysis is tiered to programmatic documents such as PACFISH and INFISH, and the R6 2005 FEIS. At the project scale, the different treatment methods were mapped and overlaid with fish distribution to see if potentially harmful treatments might occur in proximity to habitat for aquatic species of conservation concern. The analysis on treatments is focused within infested areas that lie within 100 feet of aquatic habitat. [19]

[19] If any part of the infested area is within 100 feet of a stream or other water body, the entire area is considered a "riparian unit" even if only a portion of the infested sites is near the water body.

Analysis includes consideration of effects at the infested site scale and also at various watershed scales to determine relative risk to fish from the project. The SERA Risk Assessments and GLEAMS model (see Soil and Water section above for details) were used to determine whether herbicide use could result in measurable delivery of herbicide to the stream. For all treatment types (herbicide and non-herbicide), we determined the potential for ground disturbing activity that could result in sediment delivery to a stream.

The spatial analysis boundary for aquatics effects are is the administrative boundary of the Malheur National Forest. Detectable effects, such as increased turbidity resulting from sediment created by the project, are not expected to extend beyond the Malheur National Forest boundary. The temporal boundary for analysis extends 15 years into the future (the life of the project). “Short-term” effects refer to the time period within 2 years of site-specific (e.g., within a watershed) implementation, with “long-term” extending from 2-15 years. The spatial and temporal boundaries are identical for all effects: direct, indirect, and cumulative.

Incomplete and Unavailable Information

The distribution of aquatic organisms throughout the entire analysis area (forest administrative boundary) is not precisely known. The locations of actual treatment could change over time as new sites of invasive plants are discovered or known sites change in size. To ensure that the analysis covers conditions subject to change over time (see Early Detection and Rapid Response discussion in chapter 2), we developed treatment sideboards and caps, and added many layers of caution to ensure that the analysis describes a worst case scenario in terms of adverse effects to aquatic species of concern. Thus, although the precise locations, timing and specific treatment methods in any watershed may vary, the impacts have been considered in this analysis.

Alternative A

Since no project activities would occur, there are no direct, indirect, or cumulative effects associated with choosing the no-action alternative. Not taking action means that the need for eradication, control, containment and suppression of invasive plants would not occur and adverse effects on native plant communities described previously would continue. Aquatic habitats are harmed when invasive species outcompete native vegetation. Native vegetation supports the biotic (e.g., invertebrate community) and abiotic (soil stabilization) attributes necessary for high quality aquatic habitat. Continued expansion of invasive plants, as is likely occur with no action, (see chapter 3.1.4), would continue to change near-stream biotic and abiotic attributes, and could degrade aquatic and riparian habitats.

Alternative B

Introduction

The following analysis discusses the potential direct and indirect effects on near-stream and aquatic habitat indicators at the site and small watershed scale. Unless otherwise specified, the analysis of habitat indicators is relevant to all fish species (federally listed, USFS Sensitive, and MIS) as they share overlapping habitat and have very similar habitat requirements.

In summary, serious adverse effects on aquatic organisms, in the short or long term, are unlikely. Concentrations of herbicides potentially delivered to any water body on the Forest would remain well below levels capable of measurably affecting aquatic organisms (chapter 3.4 GLEAMS model results). Potential effects due to sediment input are discussed below; while sediment contribution from invasive plant treatments would be relatively minor, treatments in riparian areas could result in minor local changes to fish habitat.

Direct and Indirect Effects

Risk assessment worksheets produced by SERA and based on the comprehensive reports (SERA, 2001, 2004a-d, 2005, 2007, and 2011a-d) have listed concentration levels deemed at acute or chronic toxicity for aquatic organisms potentially at risk from water contamination. Table 43 lists these thresholds. Generally, the lowest toxicity index available for the species most sensitive to effects was used. Measured chronic data (NOEC) was used when they were lower than 1/20th of an acute LC50 because they account for at least some sublethal effects, and doses that are protective in chronic exposures are more certain to be protective in acute exposures.

Table 43. Levels of concern for fish from project herbicides based on the R6 2005 FEIS and 2007 SERA Risk Assessment for aminopyralid

Herbicide	Duration	Endpoint*	Dose**	Species	Effect Noted at LOAEL***
Aminopyralid	Acute	NOEC	50mg/l	Rainbow Trout	None available
	Chronic	NOEC	1.35 mg/l	Rainbow Trout	None available
	Chronic	NOEC[1]	3.2 mg/L	Brown trout	rainbow trout length affected at 66mg/L
Clopyralid	Acute	NOEC	5 mg/L (1/20th of LC50)	Rainbow trout	LC50 at 103 mg/L
	Chronic				none available
Glyphosate (no surfactant)	Acute	NOEC	0.5 mg/L (1/20th/LC50)	Rainbow trout	LC50 at 10 mg/L
	Chronic	NOEC	2.57 mg/L[2]	Rainbow trout	Life-cycle study in minnows; LOAEL not given
Glyphosate with POEA surfactant	Acute	NOEC	0.065 mg/L (1/20th of LC50)	Rainbow trout	LC50 at 1.3 mg/L for fingerlings (surfactant formulation)
	Chronic	NOEC	0.36 mg/L	salmonid	estimated from full life-cycle study of minnows (surfactant formulation)
Imazapic	Acute	NOEC	100 mg/L	all fish	at 100 mg/L, no statistically sig. mortality
	Chronic	NOEC	100 mg/L	fathead minnow	No treatment related effects to hatch or growth
Imazapyr	Acute	NOEC	5 mg/L (1/20th LC50)	trout, catfish, bluegill	LC50 at 110-180 mg/L for North American species
	Chronic	NOEC	43.1 mg/L	Rainbow	“nearly significant” effects on early life stages at 92.4 mg/L
Metsulfuron methyl	Acute	NOEC	10 mg/L	Rainbow	lethargy, erratic swimming at 100 mg/L
	Chronic	NOEC	4.5 mg/L	Rainbow	standard length effects at 8 mg/L
Picloram	Acute	NOEC	0.04 mg/L (1/20th LC50)	Cutthroat trout	LC50 at 0.80 mg/L
	Chronic	NOEC	0.55 mg/L	Rainbow trout	body weight and length of fry reduced at 0.88

Herbicide	Duration	Endpoint*	Dose**	Species	Effect Noted at LOAEL***
					mg/L
Sethoxydim	Acute	NOEC	0.06 mg/L (1/20th LC50)	Rainbow trout	LC50 of Poast at 1.2 mg/L
	Chronic	NOEC			none available
Sulfometuron methyl	Acute	NOEC	7.3 mg/L	Fathead minnow	No signs of toxicity at highest doses tested
	Chronic	NOEC	1.17 mg/L	Fathead minnow	No effects on hatch, survival or growth at highest doses tested
Triclopyr acid	Acute	NOEC	0.26 mg/L (1/20th LC50)	Chum salmon	LC50 at 5.3 mg/L[3]
	Chronic	NOEC	104 mg/L	Fathead minnow	Reduced survival of embryo/larval stages at 140 mg/L
Triclopyr BEE	Acute		0.012 mg/L	Bluegill sunfish	LC50 at 0.25 mg/L
	Chronic[4]	NOEC	104 mg/L	Fathead minnow	Reduced survival of embryo/larval stages at 140 mg/L

*--NOEC = No Observed Effect Concentration
**--LC50, Lethal Concentration, 50% kill
***--LOAEL—Lowest Observed Adverse Effect Level

The GLEAMS model was run on four sites within the project area that had the greatest potential for herbicide delivery to water near fish habitat. Results indicate that herbicide concentrations in the water are at least 3 orders of magnitude less than levels of concern for fish, amphibians and aquatic invertebrates (table 38, chapter 3.5.3). Very little herbicide would reach water, even in an unbuffered scenario, because most of the herbicide is taken up in the plants and soil. The greatest amount of herbicide reaching streams in the GLEAMS model results was 0.0011ppm (same as mg/l). This was for the herbicide imazapyr. The acute threshold of concern for this herbicide is 5 mg/l; several orders of magnitude larger than the expected peak concentration in water, even in the unbuffered, high risk sites).

Indirect effects from herbicide and non-herbicide treatment methods are possible if bare soil exists following treatment, due to the potential for erosion and sediment delivery to streams, primarily in the time period between application and native plant regrowth, when soil may be slightly destabilized. Vegetation reduction in near-stream areas could slightly alter the food base for fish by changing habitat for terrestrial invertebrates; this potential effect would be short term and affect a small minority of total terrestrial habitat. The common control measures (table 8) describe the types of treatments proposed for the invasive plant target species currently mapped on the Malheur National Forest.

Project design features and annual and life of the project “caps” would be implemented to minimize or eliminate adverse effects at any scale, even assuming the maximum possible treatment that could occur. Effects capable of reaching an adverse level for federally listed fish would be related to short-term (a few years post-treatment) increases in sediment and turbidity; both herbicide and non-herbicide treatment methods could destabilize near-stream soils, though non-herbicide methods (e.g., pulling) generally pose a greater risk due to increased soil disturbance. Watershed-based results were extrapolated to the western ridged mussel through the assumption that this sympatic species shares most habitat requirements with native fish, and results are logically transferable. Assuming that near-stream native vegetation is beneficial to aquatic habitat, the long-term result of this project for all aquatic species would be positive

as invasive plants are replaced by native species. This change would presumably occur within a few years post-treatment in most cases.

Effects on Habitat Indicators

The proposed action would have minimal effects on habitat for aquatic organisms, including species of conservation concern. As discussed above, PACFISH-INFISH established riparian management objectives to maintain or restore habitat quality for aquatic organisms. Habitat indicators are monitored to ensure the trend is in a positive direction, especially over the long term. The PACFISH –INFISH habitat indicators are pool frequency, water temperature, amount of large woody debris, lower bank angle of the creek, and width to depth ratio. Treatment of invasive plants on the Malheur National Forest is not likely to measurably affect any of these indicators. Further discussion about fish habitat indicators is in the sections below. Several overlapping types of analysis are done for aquatic organisms, mainly focused on species of conservation concern. The following is an analysis of the effects on *Steelhead Primary Constituent Elements* (PCE) for designated critical habitat (NMFS 2005) as determined via analysis of "*Matrix of Pathways and Indicators*" (MPI) analysis. This analysis also covers the *Essential Habitat Features* of Chinook salmon designated critical habitat.

The following analysis results are largely dependent upon project design features and project caps that were developed to minimize or prevent a wide range of effect types. A selection of those particularly important to chemical contamination and sediment habitat indicators includes the following:

- Variable width herbicide-use buffers for all herbicides based on aquatic risk (table 10 and table 11).
- No more than 10 percent of the total acres of any 6th field watershed, and no more than 10 acres within 100 feet of any water body in a 6th field watershed would be treated with herbicide in a single year.
- In riparian and aquatic settings, vehicles (including all-terrain vehicles) used to access invasive plant sites or for broadcast spraying will not travel off roadways, trails and parking areas..

For the complete list of project design features see table 9.

PCE Crosswalk – Bull Trout

A crosswalk between the Bull Trout Matrix of Pathways and Indicators (MPI) and Primary Constituent Elements (PCEs) of Proposed Critical Habitat. The Matrix of Pathway Indicators (MPI) for bull trout is used to evaluate and document baseline conditions and to aid in determining whether a project is likely to adversely affect or result in the incidental take of bull trout.

The MPI analysis incorporates 4 population indicators and 19 physical habitat indicators. Analysis of the habitat indicators can provide a thorough evaluation of the existing baseline condition and potential project impacts to the PCEs of proposed critical habitat for bull trout. Table 44 shows the relationship between the PCEs for bull trout critical habitat and the MPI habitat indicators.

The limited ground disturbance and absence of in-stream treatment would limit potential effects to the following habitat indicators: temperature, sediment, chemical contaminants/nutrients, large woody debris, pool frequency and quality, and riparian conservation areas. The majority of these effects would be of very low magnitude, and undetectable in most areas. Treated riparian area vegetation would likely experience rapid regrowth, and the majority of near-stream vegetation would not be treated. Stream reaches where treatment is concentrated could experience measurable levels of sediment/turbidity increase post-project during storm events, but these effects would be spatially restricted, short-term, and low-magnitude. PCEs potentially affected (most undetectable) include: 1, 2, 3, 4, 5, 6, 7, and 8. Note: A detailed analysis of habitat indicators and PCEs will be completed within the fisheries biological assessment for the selected alternative

Table 44. Bull trout PCEs and MPI habitat indicators

Diagnostic Pathway Indicator	PCE 1	PCE 2	PCE 3	PCE 4	PCE 5	PCE 6	PCE 7	PCE 8	PCE 9
	Springs, seeps, groundwater	**Migratory Habitats**	**Abundant food base**	**Complex habitats**	**Water Temperature**	**Substrate Features**	**Natural Hydrograph**	**Water quality and quantity**	**Predators competition**
Water Quality									
Temperature		x	x		x			x	
Sediment		x	x			x		x	
Chemical contaminants nutrients	x	x	x					x	
Habitat Access									
Physical Barriers	x	x	x						x
Habitat Elements									
Substrate Embeddedness	x		x			x			
Large Woody Debris				x		x			
Pool Frequency and Quality			x	x		x			
Large Pools				x	x				
Off-Channel Habitat				x	x				
Refugia		x			x				x
Channel Conditions and Dynamics									
Wetted Width/Maximum Depth Ratio		x		x	x				
Streambank Condition	x			x	x	x			
Floodplain Connectivity	x		x	x	x		x	x	
Flow/Hydrology									
Changes in Peak/Base Flows	x	x			x		x	x	
Drainage Network Increase	x						x	x	
Watershed Conditions									
Road Density and Location	x				x		x		
Disturbance History				x			x	x	x
Riparian Conservation Areas	x		x	x	x		x		
Disturbance Regime				x			x	x	

Pathway: Water Quality

Indicator: Temperature, PCE Crosswalk: Spawning, Rearing, Migration habitat PCEs

Stream temperature is controlled by many variables at each site. These include topographic shading, stream orientation, channel morphology, discharge, air temperature, and interactions with ground water, which would not be measurably influenced by invasive plant treatments in the vast majority of treatment locations. In a few areas, treatment of invasive plants would change understory and ground vegetation, and would be limited in quantity by project design features and project "caps," the majority of shade-providing vegetation is expected to be retained. This small percentage near-stream areas needing treatment would not be capable of changing solar radiation to a degree that would measurably affect stream temperature. Therefore, direct or indirect effects on the temperature indicator would not affect spawning, rearing, or migration PCEs.

Pathway: Water Quality

Indicator: Chemical Contaminants/Nutrients, PCE Crosswalk: Spawning habitat PCEs

The most likely routes for herbicide delivery to water are potential runoff from a large rain storm soon after application, especially from treated roadside ditches. Other concerns such as drift, overspray, and spills are addressed through project design features were designed to control drift and overspray.

GLEAMS model results (table 38, chapter 3.5.3) indicate that no chemical water concentrations would approach levels of concern for any aquatic species, therefore effects from chemical contamination are expected to be negligible in all project watersheds.

The potential risk from accidental spills in RHCAs exists; however, pdf G describes the mechanism to minimize the occurrence and restrict highly concentrated chemicals proximity to water.

In summary, alternative B is not likely to adversely affect water quality or result in water contamination that could adversely affect fish.

Pathway: Channel Condition & Dynamics

Indicator: Floodplain Connectivity, PCE Crosswalk: Rearing habitat PCE

Some invasive plant treatments can have long-term positive effects on floodplains and streambanks when infestations of invasive plants on valley bottom areas are removed. Valley-bottom infestations often encroach on floodplains where road-related, grazing, or recreational activities have led to the establishment of invasive plant populations. Removal of such infestations is expected to benefit aquatic and terrestrial communities in the long-term by increasing floodplain area available for nutrient, sediment and large wood storage, and flood flow refugia. Potential localized, short-term, and low-magnitude sediment/turbidity increases would not be sufficient to alter channel condition and dynamics. Therefore, alternative B is unlikely to affect floodplain connectivity or fish rearing habitat.

Pathway: Habitat Access

Indicator: Physical Barriers, PCE Crosswalk: Migration habitat PCE

Invasive plant treatments would not create physical barriers or otherwise degrade access to aquatic habitat since there is no causal mechanism from proposed activities. Habitat access, physical barriers and migration habitat would not be affected by alternative B.

Pathway: Habitat Elements

Indicator: Substrate/Sediment, PCE Crosswalk: Spawning, Rearing habitat PCEs

Herbicide treatment methods that would be utilized within the riparian areas include spot- spray and hand applications. These treatment types are unlikely to produce measurable sediment in the majority of locations because very little ground disturbance would take place, though very minor inputs could conceivably occur during the period of time between plant death and regrowth. Manual labor such as hand pulling may result in localized soil disturbance, but increases of sediment to streams would likely be undetectable in most areas. In the few areas where more intense treatment could occur, disturbance areas would be limited in quantity by herbicide-use buffers, project design features and project "caps".

Sediment increases would be limited to short-term (e.g., a few hours/days) inputs during, and immediately following, intense precipitation events. A small increase in turbidity is the most likely effect and minor increases in surface fines could occur in some pool habitat. The substrate/sediment indicator would not be measurably affected over the long-term because treatment of invasive plants would not result in a chronic sediment source; less disturbance would occur during retreatment because populations would decrease each treatment entry (see 3.1.4 for more information on treatment effectiveness). Sediment could affect spawning and rearing PCEs over the short-term within a small minority of available habitat; however no measurable change is expected long-term.

Indicator: Large Woody Debris, and Pool Area, Quality and Frequency, PCE Crosswalk: Spawning habitat PCE

Treatment of invasive plants would not impact pool area, quality, and frequency as a causal mechanism does not exist.

Near-stream treatment of invasive plants would not impact current wood debris in streams. As the vast majority of native vegetation would be retained in all treatment sites, it is highly unlikely that future woody debris recruitment would be affected. Therefore, spawning habitat would not be affected by changes to the large woody debris, and pool area, quality and frequency indicators

Pathway: Flow/Hydrology

Indicator: Change in Peak/Base Flows, PCE Crosswalk: Spawning, Rearing, Migration habitat PCEs

A small percentage of each watershed (even small subwatershed) would be treated during a single year; in most cases it would be less than one percent. Project "caps" establish an absolute maximum of 10 percent of any 6th field watershed per year, but this is highly unlikely to occur given that the current level of infestation is far lower. The treatments will not affect stream flow or fish migration habitat.

Effects at the 5th field Watershed Scale

Several 5th field watersheds have scattered infestations within 100 feet of aquatic habitat (table 45). The focus of the effects analysis for aquatic organisms is on the eight 6th-field watersheds where more than one-half of 1 percent of the area within 100 feet of streams or other water bodies is infested. [20] These include: Big Creek, Camp Creek, Middle South Fork John Day River, North Basin, Pine Creek, and Upper Middle Fork John Day River (figure 12).

[20] Treatment of scattered infestations that occupy less than one-half of one percent of the riparian area in a 6th-field watershed are unlikely to have any detectable effects to fish or other aquatic organisms (professional judgment, Mease 2013). This is a very conservative level, far below the treatment limits associated with the pdfs and annual and life of the project caps.

Table 45. Invasive Plants and Fish Species in 5th field watersheds

Watershed Name (alphabetical order)	HUC 5 code	Infested acres	Percent of total near-stream area	Fish species*
Big Creek (Middle Fork John Day River)	1707020303	49.80	**1.04%**	BT, CH, ST, RT
Camp Creek (Middle Fork John Day River)	1707020302	94.96	**.69%**	BT, CH, ST, RT
Middle South Fork John Day River	1707020103	27.62	**.96%**	CH, ST, RT, WT
North Basin (Malheur River)	1712000101	15.97	**.51%**	RT
Pine Creek	1705011603	31.01	**1.45%**	RT
Upper Middle Fork John Day River	1707020301	94.21	**1.50%**	BT, CH, ST, RT

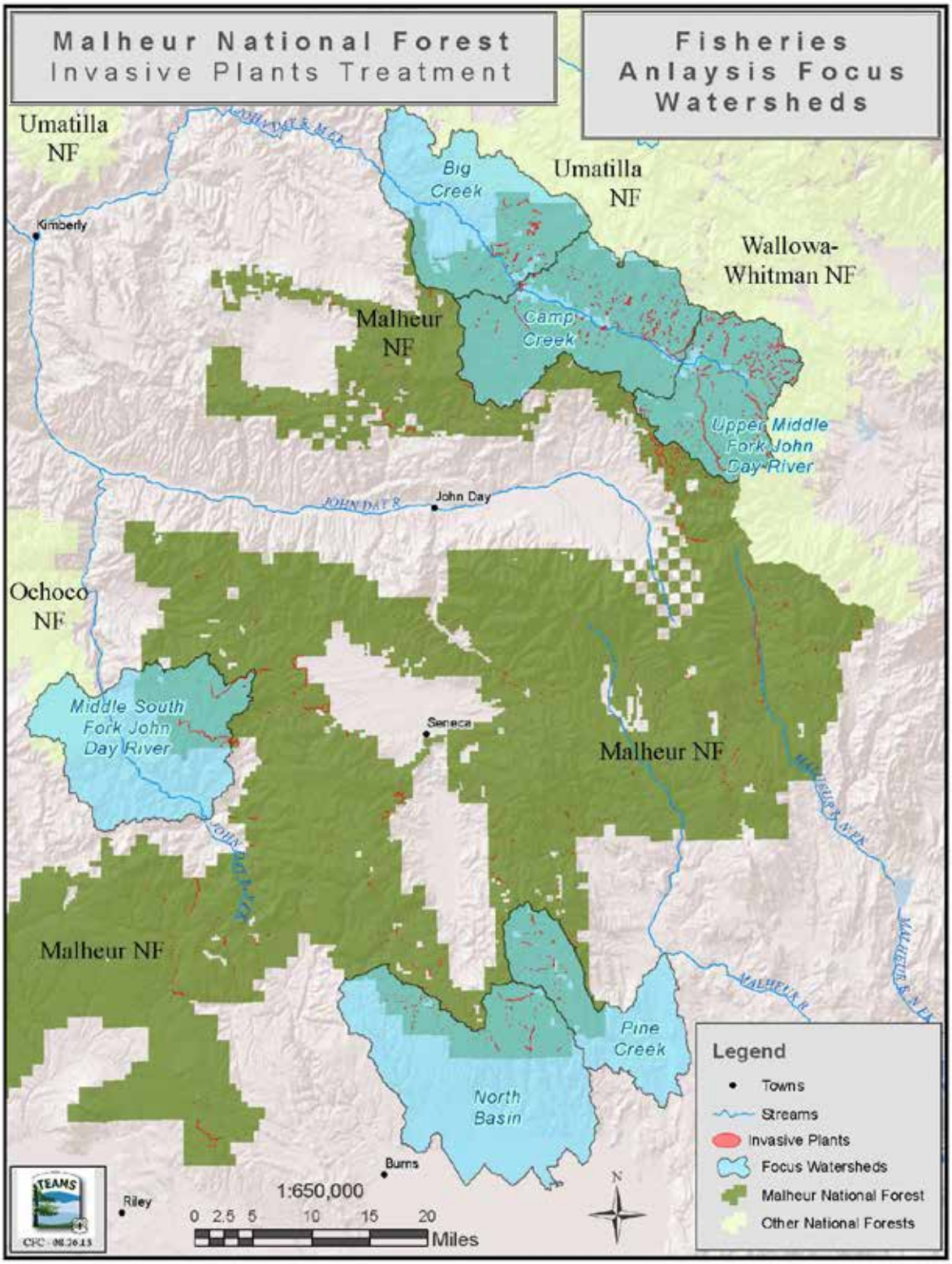

Figure 12. Focus watersheds for fisheries analysis

Big Creek Watershed

Approximately 49.80 acres (1.04%) of near-stream treatment is proposed on National Forest System land within this watershed.

This watershed contains critical habitat for both steelhead and bull trout, and essential fish habitat for Chinook salmon. Habitat exists for redband trout, westslope cutthroat trout (not currently present), and western ridged mussel. This watershed is an example of "higher" relative risk, since it contains a relatively higher percentage of treatment and contains multiple aquatic species of special conservation concern.

Based on proximity, detectable sediment effects (e.g., turbidity) could potentially occur in spot locations within the following steelhead and/or bull trout critical habitat streams: Middle Fork John Day River, Elk Creek, Deep Creek, Mosquito Creek, Deadwood Creek, and Swamp Gulch. The areas of highest relative risk for measurable sediment effects are along Deep Creek and Mosquito Creek, where, respectively, approximately 1 mile (16 acres) and ½-mile (5-8 acres) of treatment are proposed. The remainders of the units are small and spatially separated. Potential sediment/turbidity effects to fish include, but are not limited to: altering behavior (e.g., feeding efficiency), gill trauma, oxygen depletion, reduction in habitat quality for multiple life stages, and reduction of food organisms. These segments represent less than 10 percent of stream length within the sub-watershed; therefore any effects would be low magnitude and short term.

Camp Creek Watershed

Approximately 94.96 acres (.69%) of near-stream treatment is proposed on National Forest System land within this watershed.

This watershed contains critical habitat for both steelhead and bull trout, and essential fish habitat for Chinook salmon. Habitat exists for redband trout, westslope cutthroat trout, Columbia spotted frog, and aquatic invertebrates. This watershed is an example of "higher" relative risk, since it contains a relatively higher percentage of treatment and contains multiple aquatic species of special conservation concern.

Infestations are widely distributed throughout this watershed, both along critical habitat and in tributary reaches. Based on proximity, detectable sediment effects (e.g., turbidity) could potentially occur in spot locations within the following steelhead and/or bull trout critical habitat streams: Camp Creek, Cottonwood Creek, Lick Creek, Myrtle Creek, Big Boulder Creek, Badger Creek, Dry Creek, Beaver Creek, Ragged Creek, Butte Creek, Little Boulder Creek, Windlass Creek, Tincup Creek, Granite Boulder Creek, Vincent Creek, Vinegar Creek, Davis Creek, Placer Gulch, Middle Fork John Day River, Blue Gulch, Lemon Creek. The areas of highest relative risk for measurable sediment effects are along Caribou Creek and Little Boulder Creek, where approximately ½-mile of treatment would occur along each stream. The remainders of units are small (less than ¼-mile along stream) and spatially separated. Potential sediment/turbidity effects to fish include, but are not limited to: altering behavior (e.g., feeding efficiency), gill trauma, oxygen depletion, reduction in habitat quality for multiple life stages, and reduction of food organisms. In total, segments proposed for treatment represent less than 10 percent of stream length within any sub-watershed; therefore any effects would be low magnitude and short term.

Middle South Fork John Day River

Approximately 27.62 acres (.96%) of near-stream treatment is proposed on National Forest System land within this watershed.

This watershed contains critical habitat for steelhead and essential fish habitat for Chinook salmon. Habitat exists for redband trout and westslope cutthroat trout.

Most of the treatment proposed in this watershed is along Deer Creek and North Fork Deer Creek, both of which are designated critical habitat. Potential sediment/turbidity effects to fishes include, but are not limited to: altering behavior (e.g., feeding efficiency), gill trauma, oxygen depletion, reduction in habitat quality for multiple life stages, and reduction of food organisms. More than a mile of treatment could occur along these two streams. Project "caps" would limit total annual treatment to 10% of the 6th field watershed (Corral Creek) where a relatively high concentration of sites exists. In addition, no more than 10 acres of treatment would occur per year within 100 feet of streams in this sub-watershed. Because more treatment could be concentrated in a localized area, sediment/turbidity could be of greater magnitude than other areas (low moderate), however duration would be short term.

North Basin

Approximately 15.97 acres (.51%) of near-stream treatment is proposed on National Forest System land within this watershed.

There is no critical habitat for federally listed species within this watershed. Redband trout may be present.

Based on proximity, detectable sediment effects (e.g., turbidity) could potentially occur in spot locations within the following streams: Polson Creek, Devine Canyon, Armstrong Canyon, Cow Creek, Rattlesnake Creek, East Fork Rattlesnake Creek, West Fork Rattlesnake Creek, and Middle Fork Rattlesnake Creek. A few sites within the Rattlesnake Creek drainage are approximately ½-mile in length; these sites pose the greatest risk of potentially measurable sediment/turbidity effects. Because less than 10 percent of this sub-watershed would be treated, any effects that could occur would be of low magnitude and short term.

Pine Creek

Approximately 31.01 acres (1.45%) of near-stream treatment is proposed on National Forest System land within this watershed.

There is no critical habitat for federally listed species within this watershed. Redband trout may be present.

Based on proximity, detectable sediment effects (e.g., turbidity) could potentially occur in spot locations within the following streams: Pine Creek and unnamed tributaries, West Fork Pine Creek, and Alkali Creek and unnamed tributary. One site along an unnamed tributary in the headwaters of Pine Creek, and a site along West Fork Pine Creek, each exceed ½-mile in length. These areas pose the greatest risk of producing measurable sediment/turbidity effects. Potential sediment/turbidity effects to fishes include, but are not limited to: altering behavior (e.g., feeding efficiency), gill trauma, oxygen depletion, reduction in habitat quality for multiple life stages, and reduction of food organisms. Because less than 10 percent of this sub-watershed would be treated, any effects that could occur would be of low magnitude and short term.

Upper Middle Fork John Day River

Approximately 94.21 acres (1.50%) of near-stream treatment is proposed on National Forest System land within this watershed.

This watershed contains critical habitat for steelhead and bull trout, and essential fish habitat for Chinook salmon. Habitat exists for redband trout, westslope cutthroat trout (not currently present), and western ridged mussel. This watershed is an example of "higher" relative risk, since it contains a relatively higher percentage of treatment and contains multiple aquatic species of special conservation concern.

Based on proximity, detectable sediment effects (e.g., turbidity) could potentially occur in spot locations within the following steelhead and/or bull trout critical habitat streams: Middle Fork John Day River, Bridge Creek, Clear Creek, Dry Fork Clear Creek, Mill Creek, Crawford Creek, Summit Creek, Idaho Creek, and Squaw Creek. The area of highest relative risk for measurable sediment effects is along Crawford Creek, where more than a mile of treatment along the stream is proposed. Project "caps" would limit total annual treatment to 10 percent of the 6th field watershed (Mill Creek) where this relatively high concentration of sites exists. In addition, no more than 10 acres of treatment would occur per year within 100 feet of streams in this sub-watershed. Because there would be more treatment concentrated in a localized area, sediment/turbidity could be of greater magnitude than other areas (low-moderate), however duration would be short term.

Species of Conservation Concern Determinations

Based on quantity of proposed treatment near streams, short-term detectable effects were determined to be possible in six watersheds (5th field HUC): Big Creek, Camp Creek, Middle South Fork John Day River, North Basin, Pine Creek, and Upper Middle Fork John Day River. Measurable effects in other watersheds from treatment of currently mapped infestations are not expected. , More site-specific information about fisheries impacts at the sub-watershed scale (6th field HUC) will be developed through the ongoing ESA Section 7 consultation process.

Federally Listed Fishes and their Designated Critical Habitat

For federally listed species (steelhead, bull trout) and essential fish habitat (Chinook salmon), the potential for short-term adverse effects was determined to exist in four watersheds within the project area: Big Creek, Camp Creek, Middle South Fork John Day River, and Upper Middle Fork John Day River. Although effects (sediment/turbidity) from these activities are expected to be minor, they could exceed the "discountable" threshold, and are therefore "likely to adversely affect fish and their designated critical habitat" (see preceding watershed scale analysis for rationale). Potential effects to habitat indicators other than sediment are not expected to approach adverse levels. Consultation will be completed with U.S. Fish and Wildlife Service and the National Marine Fisheries Service on the preferred alternative prior to a final agency decision.

Forest Service Sensitive Species

Forest Service Sensitive species (trout and mussel) exhibit largely overlapping ranges and similar vulnerability to effects with the federally listed fishes; therefore, the following determination applies: "May impact individuals, but is not likely to cause a trend toward federal listing or loss of viability within the planning area."

Forest Service Management Indicator Species

Forest Service Management Indicator Species (MIS) (resident trout group – e.g., redband) overlap the distribution of federally listed fishes, and exhibit similar vulnerability to effects. In summary, there would be no reduction in quantity (miles) of stream habitat due to project actions. Habitat quality may be slightly reduced in the short-term due to post-implementation sediment input resulting from dead near-stream vegetation. This potential effect would occur within a fraction of 1 percent of available habitat; therefore, the following determination applies: "May impact individuals, but is not likely to cause a trend toward federal listing or loss of viability within the planning area." In the long term, near-stream conditions would be improved as native vegetation re-establishes.

Table 46. Draft Determinations for Fish Species of Conservation Concern

Species	Status	Determination
Middle Columbia River steelhead DPS and designated critical habitat	Federally threatened	May affect, likely to adversely affect.
Columbia River and Malheur River bull trout SMUs and designated critical habitat	Federally threatened	May affect, likely to adversely affect.
Middle Columbia River Chinook salmon	Essential fish habitat and USFS sensitive	Adverse modification of essential fish habitat. May impact individuals, but is not likely to cause a trend toward federal listing or loss of viability within the planning area.
Redband trout	USFS sensitive	May impact individuals, but is not likely to cause a trend toward federal listing or loss of viability within the planning area.
Westslope cutthroat trout		
Western ridged mussel		
Resident trout group (same effects as above for same/other trout species)	USFS Management Indicator Species (MIS)	May impact individuals, but is not likely to cause a trend toward federal listing or loss of viability within the planning area.

Land and Resource Management Plan Amendment

The effects of adding aminopyralid to the list of available herbicides would not adversely affect fish. The Environmental Protection Agency classified aminopyralid as a “reduced risk” herbicide and stated that the use of aminopyralid as a replacement for other herbicides will decrease risk to some nontarget species [including fish] (U.S. EPA 2005 *in* SERA 2007 Risk Assessment).

Early Detection and Rapid Response

The early detection and rapid response component of the project would have similar impacts to treatment of known sites due to the implementation planning process that would ensure new detections are treated according to pdfs, treatment caps and herbicide-use buffers. The greatest potential impact would be localized sediment/turbidity of low-moderate magnitude as discussed above for areas that currently have the highest concentration of invasive plants in a subwatershed.

Direct and Indirect Effects of Alternative C

The conclusions from the analysis for alternative B generally apply to alternative C, with the following qualitative differences and clarifications.

- The risk of chemical contamination of aquatic habitat from herbicide application associated with alternative B would be eliminated due to the absence of near-stream herbicide application. See GLEAMS model results for alternative C in chapter 3.5.3 indicating the absence of any herbicide reaching streams due to the prohibition on any herbicide use within 100 feet of streams.
- A measurable increase in sediment production could result from alternative C as compared to alternative B due to an increase in non-herbicide methods, many of which would produce more soil disturbance and associated mobilization into stream channels (see chapter 3.4). Treatments would be less effective and would require more treatment entries to reach desired conditions (see chapter 3.1.4) which could compound the potential effect on sediment and turbidity.
- To the extent that the greater costs and time to reach desired conditions associated with alternative C (see chapter 3.1.4), there could be less short- and long-term benefit to the aquatic environment.

Direct and Indirect Effects of Alternative D

The conclusions from the analysis for alternative B generally apply to alternative D, with the following qualitative differences and clarifications.

The risk of harm to aquatic habitat from herbicide application would increase because of increased use of picloram and glyphosate, two of the herbicides posing greatest risk to aquatic organisms. However, despite the increased use of these herbicides, GLEAMS model results show a low risk of these herbicides reaching streams. Project design features, herbicide-use buffers and project "caps" provide substantial protection, making detectable difference in effects to aquatic organisms and their habitat unlikely, except in the case of an unexpected over-application (e.g., spill near water). To the extent that the greater costs and time to reach desired conditions associated with alternative D (see chapter 3.1.4), there could be less short- and long-term benefit to the aquatic environment. All other potential effects would be similar to alternative B, including sediment from all treatment methods.

Cumulative Effects of All Action Alternatives

The baseline for cumulative effects analysis is the current condition as described in the affected environment section above. The differences between alternatives in terms of impacts to fisheries are so small that cumulative effects would be the same across alternatives.

Current and reasonably foreseeable actions on National Forest System lands are listed in chapter 3.1.5. Actions that could add to effects within specific watersheds where measureable project-related effects (e.g., sediment production) are deemed possible will be addressed qualitatively within the analysis below. For the remaining watersheds, where project effects are deemed absent or "discountable", there would be no meaningful additions to the combined effects from other actions.

Herbicides are commonly applied for a variety of agricultural, landscaping and invasive plant management purposes. Herbicide use occurs on tribal lands, state and county lands, private forestry lands, rangelands, utility corridors, road rights-of-way, and private property. Studies (see chapter 3.1.5) have shown that pesticides are commonly found in surface waters in Oregon and throughout the United States. However, the studies indicate that herbicide use similar to the type proposed in this project would not result in harmful concentrations of herbicide in water. These potential additions will be analyzed qualitatively based on percentage of non-national forest lands present within specific watersheds where effects are potentially measurable.

Based on the preceding analysis and professional judgment, potential project effects would represent a very small percentage of the total (cumulative) from all actions combined. Natural background seasonal fluctuation along with sediment/turbidity effects from other actions (e.g., roads, timber harvest, grazing) exceeds any potential production from invasive plant treatment by orders of magnitude. Herbicide concentrations from the project are expected to be undetectable or very low in all waterways, and would therefore add little or nothing to cumulative effects.

Sediment production from project actions could add to sources derived from other actions on National Forest System lands, tribal lands, state and county lands, private forestry lands, rangelands, utility corridors, road rights-of-way, and private property. These potential additions will be analyzed qualitatively based on percentage of lands of other ownerships present within specific watersheds where effects are potentially measurable.

Within the six watersheds where project-related sediment/turbidity effects could potentially exceed the "discountable" threshold, effects are low magnitude and short term. Streams listed (303(d)) for sediment within the Middle Fork John Day and Upper John Day watersheds (see Water Quality section) are not expected to incur any detectable long-term sediment additions from project activities; spatially isolated

short-term sediment effects would be limited to low-magnitude turbidity increases and pool surface-fines. Analysis at the sub-watershed level (6th field HUC) will be completed as part of the Section 7 ESA consultation process.

Table 47. Cumulative effects, qualitative estimates within focus watersheds for fisheries

Watershed Name	Currently Infested acres	Other current/future Federal actions capable of contributing sediment	Percent of watershed private land (approximate)	Project-related sediment based on current infestations	Long-Term Total
Big Creek (Middle Fork John Day River)	50	Road maintenance, grazing	60%	Low quantity, short duration (<2 years)	Pre-project levels
Camp Creek (Middle Fork John Day River)	100	Road maintenance, prescription fire, timber harvest, road closures/decommissioning, culvert replacements, large woody debris in-stream placement, grazing	<5%	Low quantity, short duration (<2 years)	Pre-project levels
Middle South Fork John Day River	28	Road maintenance, juniper and mixed conifer cutting, fuel treatment, aspen restoration, watershed improvement activities, grazing	75%	Low quantity, short duration (<2 years)	Pre-project levels
North Basin	16	Road maintenance, snow park relocation, prescription fire, timber harvest, road closures/decommissioning, hazard trees, grazing	75%	Very low quantity, short duration (<2 years)	Pre-project levels
Pine Creek (Malheur River)	31	Road maintenance, prescription fire, grazing	60%	Low quantity, short duration (<2 years)	Pre-project levels
Upper Middle Fork John Day River	94	Road maintenance, snow park, prescription fire, timber harvest, road closures/decommissioning, aspen restoration, aquatic restoration, culvert replacements, grazing	<5%	Low quantity, short duration (<2 years)	Pre-project levels

Several other stressors on fish exist, including hydropower development, habitat degradation from human activities, direct harvest of fish, and competition from hatchery fish (USDA Forest Service 2008b). These are part of the existing condition for aquatic organisms and this project will not influence these conditions.

The analysis assumes maximum levels of treatment over the life of the project. Even given these unlikely treatment levels, project-related additions to existing cumulative effects are likely to be minor or non-existent. At any given site, direct or indirect adverse effects to aquatic organisms under all alternatives would be low magnitude, localized, and short term. The potential to affect the aquatic environment is limited to a low amount of herbicide or sediment, and minor impacts on native riparian vegetation (see

previous sections of this EIS). These effects are not of a type or extent that would combine with ongoing human activities or foreseeable projects on the Forest and produce long-term, cumulative impacts, even considering the vectors of invasive plant spread described in chapter 3.1.5.

3.7 Wildlife

3.7.1 Introduction

National Forest System land on the Malheur National Forest (Forest) provides diverse habitats for wildlife including grasslands, sagebrush and juniper; fir and pine forests and mountain lakes and meadows. These varied habitats provide for a diversity of wildlife including 365 vertebrate species including 22 fish, 9 amphibians, 14 reptiles, 235 birds and 85 mammals (Forest LRMP p. III-42). Invasive plants have become established and continue to spread, causing a loss of wildlife habitat and posing a risk of injury to wildlife on the Malheur National Forest. This section addresses the impacts and benefits of the proposed Malheur National Forest Site-Specific Invasive Plants Treatment Project on wildlife and wildlife habitat.

Regulatory Framework

The following is a summary of regulatory direction specifically applicable to the management of wildlife resources on the project area.

- National Environmental Policy Act (NEPA) of 1969 (as amended) – NEPA requires that effects of management actions on wildlife be disclosed and requires that management provide for a diversity of plant and animal communities (16 USC 1604((g)(3)(B))

- Endangered Species Act (ESA) of 1973 (as amended) - ESA requires the Forest Service to manage for the recovery of threatened and endangered species and the ecosystems, upon which they depend. Forests are also required to consult with the United States Fish and Wildlife Service if a proposed activity may affect the population or habitat of a listed species.

- National Forest Management Act (NMFA) of 1976 (as amended) - NFMA requires the Forest Service to manage fish and wildlife habitat to maintain viable populations of all native and desirable non-native vertebrate wildlife species and conserve all listed threatened or endangered species populations (36 CFR219.19).

- Executive Order 13186 (Migratory Bird Treaty Act) - The MBTA established an international framework for the protection and conservation of migratory birds. This Act makes it illegal, unless permitted by regulations, to “pursue, hunt, take, capture, purchase, deliver for shipment, ship, cause to be carried by any means whatever, receive for shipment, transportation or carriage, or export, at any time, or in any manner, any migratory bird.” Within the NEPA process, effects of proposed actions on migratory birds will be evaluated and actions will consider approaches to identify and minimize take (USDA Forest Service 2008).

- Forest Service Manual Direction regarding wildlife (FSM 2600) - Forest Service Manual direction provides guidance related to Threatened, Endangered and Sensitive (TES) species. It requires that the Forest Service identify and prescribe measures to prevent adverse modifications or destruction of critical habitat and other habitats essential for the conservation of endangered, threatened and proposed species (FSM 2670.31 (6)). It also requires the Regional Forester to identify sensitive species for each National Forest where species viability may be a concern (Under FSM 2670.32) and mitigate adverse impacts of management activities (FSM 2634).

The Forest LRMP provides comprehensive guidance for wildlife management. The wildlife report details specific objectives, standards and guidelines related to wildlife. This project has very limited impacts to wildlife species and most of the Forest LRMP wildlife management direction is not applicable to this project.

3.7.2 Affected Environment

Invasive Plants Influence Wildlife Habitat

Invasive plants are thought to generally degrade wildlife habitat, especially for species that require intact native plant ecosystems. Some wildlife species use invasive plants for food or cover. For example, American goldfinch (*Carduelis tristis*), and red-winged blackbird (*Agelaius phoeniceus*) use purple loosestrife (Kiviat 1996; and Thompson 1987), and native bighorn sheep will eat cheatgrass (Csuti et al. 2001). It has been reported that elk, deer, and rodents eat rosettes and seed heads of spotted knapweed. Doves, hummingbirds, honeybees, and the endangered southwestern willow flycatcher (*Empidonax trailii* extimus) are known to use saltcedar (Barrows 1996).

The few uses that an invasive plant may provide do not outweigh the adverse impacts to an entire ecosystem (Zavaleta 2000). Invasive plants have adversely impacted habitat for native wildlife in Oregon (ODFW 2006). Species of wildlife that depend upon native vegetation for food, shelter, or breeding can be adversely affected by invasive plants. Species restricted to very specific habitats, for example pond-dwelling amphibians, are more susceptible to adverse effects.

Displacement of native plant communities by non-native plants results in alterations to the structure and function of ecosystems and constitutes a principle mechanism for loss of biodiversity at regional and global scales (Lacey and Olson 1991). Mills et al. (1989) and Germaine et al. (1998) found that native bird species diversity and density were positively correlated with the volume of native vegetation, but were negatively correlated or uncorrelated with the volume of exotic vegetation.

Invasive plants can adversely affect wildlife species by eliminating required habitat components, including surface water (Dudley 2000; Horton 1977), reducing available forage quantity or quality (Bedunah and Carpenter 1989; Rice et al. 1997; Trammell and Butler 1995); reducing preferred cover (Rawinski and Malecki 1984; Thompson et al., 1987); drastically altering habitat composition due to altered fire cycles (D'Antonio and Vitousek 1992; Mack 1981; Randall 1996; Whisenant 1990); and physical injury, such as that caused by long spines or "foxtails" (Archer 2001). In the case of common burdock (*Arctium minus*), the prickly burs can trap bats and hummingbirds and cause direct mortality to individuals (Raloff 1998). Invasive plants that grow large and densely (e.g., giant reed, Himalayan blackberry) can act as physical barriers to water sources and essential habitat.

Invasive plants can act as a population sink by attracting a species and then exposing it to increased mortality or failed reproduction (Chew 1981). Schmidt and Whelan (1999) reported that native birds increased their use of exotic Lonicera and Rhamnus shrubs over native trees, even though nests built in the exotic shrubs experienced significantly higher mortality rates.

Some invasive plants (such as knapweed) contain chemical compounds that make the plant unpalatable to grazing animals. Chemical compounds in these invasive plants disrupt microbial activity in the rumen, or cause discomfort after being ingested, resulting in a reduced or avoided consumption of the invasive plant (Olson 1999).

Habitats that become dominated by invasive plants are often not used, or are used much less, by native and rare wildlife species, and species such as yellow starthistle and knapweed reduce wildlife habitat (USDA Forest Service 2007, Utah State University 2013), and degrade upland game bird habitat. Some hunters and wildlife managers are concerned that invasive plants are degrading the quality of remaining

habitat for deer and elk, adversely affecting distribution of the animals and hunting opportunities. Trammell and Butler (1995) found that deer, elk, and bison avoided sites infested with leafy spurge (*Euphorbia esula*). Tamarisk stands have fewer and less diverse populations of wildlife (Jakle and Gatz 1985; Olson 1999). Invasion by purple loosestrife makes habitat unsuitable for numerous birds, reptiles, and mammals (Kiviat 1996; Lor 2000; Rawinski 1984 and Malecki 1984; and Thompson et al. 1987; Weihe and Neely, 1997; Weiher et al. 1996). Reed canarygrass, implicated in the loss of Oregon spotted frog habitat, may have contributed to contractions in the range of Oregon spotted frogs in western Oregon (Hayes 1997; McAllister and Leonard 1997). Bald eagle mortality in other parts of the U.S. has been linked to a toxin produced by cyanobacteria that grow on the invasive aquatic plant, *Hydrilla verticillata* (Wilde 2005).

In summary, invasive plants are known or suspected of causing the following effects:

- Embedded seeds in animal body parts (e.g. foxtails), or entrapment (e.g. common burdock) leading to injury or death.
- Scratches leading to infection.
- Alteration of habitat structure leading to habitat loss or increased chance of predation (Schmidt and Whelan 1999).
- Change to effective population size through nutritional deficiencies or direct physical mortality.
- Poisoning due to direct or indirect ingestion of toxic compounds found on or in invasive plants.
- Altered food web and nutrient cycling (Allison and Vitousek 2004; Ehrenfeld 2003; Rimer and Evans 2006).
- Source-sink population demography, with more demographic sinks than sources.
- Lack of proper forage quantity or nutritional value at critical life periods.

Terrestrial Wildlife Species of Conservation Concern

Federally Listed Species

The following section discusses species that have been, are currently, are proposed for or are candidates for listing under the federal Endangered Species Act (ESA). Threatened and endangered species evaluated include the Canada lynx (threatened) and North American wolverine (proposed for listing). Three species, the bald eagle, peregrine falcon, and gray wolf have been delisted (USFWS 2007a, USFWS 20011a) and are currently managed as Region 6 sensitive species. The project area is within the range of and provides habitat for the Columbia spotted frog and greater sage grouse. Because they have not been formally listed, these two species are also Forest Service sensitive species.

Table 48. ESA species (listed, proposed, candidate, delisted)

Common Name	Scientific Name	Conservation Status	Species Presence
Canada Lynx	*Lynx Canadensis*	Threatened	Not Present
North American Wolverine	*Gulo gulo luscus*	Proposed for Listing	Suspected
Gray Wolf[1]	*Canis lupus*	Delisted-Sensitive	Suspected
Bald Eagle[1]	*Haliaeetus leucocephalus*	Delisted-Sensitive	Documented
American Peregrine Falcon[1]	*Falco peregrinus anatum*	Delisted-Sensitive	Documented

Common Name	Scientific Name	Conservation Status	Species Presence
Greater Sage Grouse[1]	*Centrocercus urophasianus*	Candidate-Sensitive	Documented
Columbia spotted frog[1]	*Rana luteiventris*	Candidate-Sensitive	Documented

[1]Evaluated as a Region 6 sensitive species (USDA Forest Service 2011)

The following is a brief description of the species' life history, threats and generally recognized species protection measures. The species status and available habitat on the project area and the amount of habitat currently affected by known invasive plant sites are also discussed. Additional information on federally listed species can also be found in the biological assessment prepared for the R6 2005 FEIS, which is incorporated by reference into this analysis.

Canada lynx

Status, Life History and Habitat Description - The population, distribution, life history, habitat status and recovery objectives for Canada lynx are detailed in Ruggiero et al. (1999), Ruediger et al. (2000), USDI Fish and Wildlife Service (2006) and USDI Fish and Wildlife Service (2007c). The following is a summary of lynx habitat preferences and biology.

Lynx are highly specialized predators of snowshoe hare (*Lepus americanus*) and habitat can generally be described as moist boreal forests that have cold, snowy winters and a snowshoe hare prey base (USDI Fish and Wildlife Service 2006). Lynx habitat generally consists of lodgepole pine, subalpine fir, and Engelmann spruce, whereas dry forest types (e.g. ponderosa pine and climax lodgepole pine) generally do not provide suitable habitat (Ruediger et al. 2000).

Snow conditions also determine the distribution of lynx (Ruggiero et al. 1999) as lynx are adapted for hunting snowshoe hares and surviving in areas that have cold winters and deep, fluffy snow for extended periods. Because of the patchiness and temporal nature of high quality snowshoe hare habitat, lynx populations require large boreal forest landscapes to ensure that sufficient high-quality snowshoe hare habitat is available at any point in time so that lynx may move freely among patches of suitable habitat and among subpopulations of lynx (USDI Fish and Wildlife Service 2009a).

Lynx are highly mobile and long-distance movements (greater than 60 miles) are characteristic (Aubry et al. 2000 in Ruggiero et al. 1999). Lynx disperse primarily when snowshoe hare populations decline. Sub-adults also disperse when prey is abundant and lynx make exploratory movements outside their home range (USDI Fish and Wildlife Service 2009a).

Lynx den sites are located where coarse woody debris, such as downed logs and windfalls and den habitat may be located in older regenerating stands or in mature forest where downed woody debris is available (USDI Fish and Wildlife Service 2007c). Lynx productivity is highly dependent on the quantity and quality of winter snowshoe hare habitat which is a limiting factor for lynx persistence.

Threats - Risk factors for lynx include direct human threat (shooting, trapping, vehicle collisions), as well as changes in forage and denning habitat. Lynx have evolved a competitive advantage in deep snow environments due to their large paws that allow them to hunt prey where other predators cannot because of snow conditions. There is a concern that compacted snow routes allow these other predator's access into isolated areas that are normally used exclusively by lynx (Wisdom et al. 2000). This increased access can also increase lynx vulnerability to harvest, collision, or harassment. These concerns have not been conclusively verified however. Fire suppression and logging have altered the mosaic of habitats needed for prey species and denning sites (ibid.). Invasive plants have not been identified as a threat to lynx.

Project Area Status - The Blue Mountains represent the southern extent of lynx distribution, which would explain the rarity of this species on the periphery of its range both historically and now (USDI FWS 2005), lynx habitat in northeast Oregon is categorized as "peripheral area". Only four relatively recent specimens are known, one from Wallowa County in 1964, Benton County in 1974, Harney County in 1993 (McKelvey et al. 2000), and near Burns in 1994. Self-maintaining populations of lynx in Oregon have not existed historically (Verts and Carraway 1998). Based on limited verified records, lack of evidence of reproduction and occurrences in atypical habitat that correspond with cyclic highs, lynx have never maintained resident populations, although they are considered an infrequent and casual visitor by the state of Oregon (Ruediger et al. 2000, pp. 4-7).

Winter track surveys for lynx and wolverine were conducted by the Forest from 1991-1994 and no confirmed lynx tracks were found. Hair snares were used to survey for lynx, according to the National Lynx Survey, during the summers of 1999-2001. There were no lynx detections confirmed from this survey effort. It is unknown whether lynx are currently present on the Forest, but there are no verified records and there is no evidence of occupation or reproduction that would indicate colonization or sustained use by lynx.

Occupied lynx habitat includes lands that either 1) have had at least two verified lynx observations or records since 1999, or 2) where there is evidence of lynx reproduction on the national forest (USDI FWS 2006a). The project area is considered unoccupied lynx habitat because neither of these conditions exists.

Lynx habitat within the project area was mapped using the vegetation and environmental conditions for the Northern Rocky Mountains geographic area, and more specifically, the Blue Mountain Section, including northeast Oregon and west-central Idaho. Primary vegetation was based on the direction provided in the Canada Lynx Conservation Assessment and Strategy (LCAS) (Ruediger et al. 2000), and follow-up guidance from the Forest Service Regional Office and the Lynx Biology Team. Sixth code Hydrologic Unit Codes (HUC), were used as the basis for delineating lynx habitat across the Malheur National Forest. Although the Lynx Conservation Agreement (May 2006), states that the LCAS does not apply to forests that are considered as having unoccupied habitat, the lynx analysis units (LAU) acreage was used to identify potential lynx habitat on the Malheur National Forest. Suitable lynx habitat occurs in the Strawberry, Glacier and Indian Lynx Analysis Units.

Table 49 identifies the total amount and type of suitable lynx habitat within project area LAUs, as defined in the LCAS, as well as known invasive plant infestations within suitable habitat.

Currently, 16 acres of suitable lynx habitat are affected by invasive plants. The small amount of habitat affected by invasive plants is due largely to the low density of roads within potential habitat, which serve as primary vectors for the spread of invasive plants and lynx prefer remote, forested areas.

Table 49. Acres of Lynx habitat in the project area

Habitat	Denning (ac)	Foraging (ac)	Total (ac)
Suitable Lynx Habitat	26,849	14,158	41,007
Habitat Affected by Invasive Plants	8	8	16

Wolverine

Status Life History and Habitat Description - The wolverine is now a proposed threatened species, per findings of the USDI Fish and Wildlife Service, 50 CFR Part 17, 78 FR 7864, Endangered and Threatened Wildlife and Plants: Threatened Status for the Distinct Population Segment of the North American Wolverine Occurring in the Contiguous United States, dated February 4, 2013, found at http://federalregister.gov/a/2013-0148. It has a global rank of G4, and is a State threatened species.

Wolverine is a solitary and highly mobile species that tends to inhabit remote areas and occurs at relatively low densities (Banci 1994). Wolverines range widely from subalpine talus slopes to big game winter ranges, occupying higher ranges in the summer and riparian habitats in the spring. Ruggiero et al (1999) found that wolverines used higher elevations in the snow-free season to avoid high temperatures and human activity. Wolverine habitat is best defined in terms of adequate year-round food supplies in large sparsely inhabited areas, rather than in terms of particular types of topography or plant associations. No particular habitat components or habitat management techniques can presently be singled out for wolverine and success of wolverine may relate to the availability of large areas of remote, rugged uplands that are difficult to access by humans (Hatler 1989). Wolverines occur in low densities in all places they have been studied (Ruggiero et al. 1994). This is generally attributed to naturally low reproductive rates and delayed sexual maturity of the species.

Wolverines are opportunistic feeders and consume a variety of foods depending on availability. They primarily scavenge carrion, but also prey on small mammals and birds, and eat fruits, berries and insects (USDI Fish and Wildlife Service 2010). In both Montana and Idaho, big game carrion appears to be the major food source with snowshoe hare, squirrels, and small mammals making up the rest of their diet (Hornocker and Hash 1981). Large mammal carrion is an important dietary component, particularly in winter when other prey is scarce (Banci 1994, Pasitschniak and Lariviere 1995) and they rely heavily on the presence of other predators. Wolverines will also search for caches made by itself, other wolverines, or other carnivores during the winter.

Female wolverines use two kinds of dens for reproduction. Females use natal (birthing) dens to give birth and raise kits early postpartum, prior to weaning. They are excavated in snow and persistent, stable snow greater than 5 ft. in depth appears to be a requirement for natal denning, (USDI Fish and Wildlife Service 2013a). In Montana, natal dens occur above 7,874 feet and are located on north aspects in avalanche debris typically in alpine habitats near timberline (USDI Fish and Wildlife Service 2013a). Prior to weaning, females may move kits to one or multiple alternate den sites, referred to as maternal dens. The movement of kits from natal to maternal dens may be a response by the female to den disturbance, better food availability in the new location, predation risk, or deteriorating den conditions in the natal den (Magoun and Copeland 1998).

Post-weaning dens are called rendezvous sites. These dens may be used through early July. Females leave their kits at rendezvous sites while foraging, and return periodically to provide food for the kits. These sites are characterized by natural (unexcavated) cavities formed by large boulders, downed logs (avalanche debris), and snow (Inman et al. 2007). They may also occur in talus or coniferous riparian zones.

Wolverine home ranges are generally extremely large and the availability and distribution of food is likely the primary factor in determining wolverine movements and home range. Home ranges of adult wolverines range from less than 38.5 square miles to 348 square miles (USDI Fish and Wildlife Service 2010). Home ranges of adult males and females overlap extensively with the range of one male covering the ranges of two to six females, which is considered one reproductive unit.

Witmer et al. (1998) suggested long-term conservation of wolverine can be achieved through maintenance of large, remote areas of habitat and engaging in management activities that do not decrease ungulate prey density.

Threats - Wolverines have few natural predators although both interspecific and intraspecific mortalities have been documented. Wolverines are susceptible to mortality through hunting and trapping and human caused disturbances near den sites (Banci 1994, Hornocker and Hash 1981, Copeland 1996). Wolverine naturally occur at low densities (Hornocker and Hash 1981, Copeland 1996) and within the area known to

currently have wolverine populations, relatively few wolverines can coexist due to their naturally low population densities.

In their proposed rule to list the wolverine as threatened (USDI Fish and Wildlife Service 2013a), it was determined that the impacts of climate change constitute a threat to the contiguous U.S. DPS of the wolverine. Wolverine populations in the remaining U.S. range appear to be at numbers so low that their continued existence could be at risk. These risks come from three main factors: (1) small total population size, 2) effective population below that needed to maintain genetic diversity and demographic stability, and 3) fragmented nature of wolverine habitat in the contiguous United States that results in smaller, isolated island patches separated by unsuitable habitats. Other threats are secondary and only rise to the level of threats to the DPS as they may work in concert with climate changes to affect the third risk factor; habitat. In their finding on the wolverine DPS, the USFWS discussed a variety of impacts to wolverine habitat including: (1) climate change, (2) human use and disturbance, (3) dispersed recreational activities, (4) infrastructure development, (5) transportation corridors, and (6) land management. The primary impact of climate change on wolverines is expected to be changes to the availability and distribution of wolverine habitat.

Project Area Status - Prior to 1973, wolverines were classified as furbearers in Oregon. Numerous animals have been collected or sighted around the northwest. A query of the Oregon Natural Heritage database reveals that there are about 150 observations of wolverines in Oregon, with most occurring in the mountainous northeast (Baker, Grant, Umatilla, Union and Wallowa Counties) region (ODFW 2013). Although recent sightings, tracks and a road kill document their presence (Csuti et al 2001), they are considered rare throughout all of Oregon, Washington, Idaho, and California.

Periodically throughout the 1990s, wolverine surveys were conducted across the Forest. Records for eastern Oregon include a partial skeleton and tufts of fur found near Canyon Mountain, Grant County (1992), tracks and a possible denning site discovered in the Strawberry Mountain Wilderness (1997), tracks that were noted in the Monument Rock Wilderness (1997), and hair and track collection on Snow Mountain Ranger District, Ochoco National Forest (1992). There have been additional unconfirmed sightings reported periodically on the Forest although there are no recent verified locations or physical evidence of their occurrence. Sightings are mostly from wilderness, or more remote, high-elevation areas.

In the Blue Mountains, source habitat for wolverine occurs primarily in wilderness and large roadless areas; although no den sites have been identified. Areas of low human impacts, low human disturbance, and high deer and elk concentrations are preferred. The best source habitat is located in the Strawberry Mountain Wilderness, Monument Rock Wilderness, Vinegar Hill-Indian Rock Scenic Area, the Jump Off Joe, Dixie Butte and Dry Cabin Wildlife Emphasis Areas, and the Shaketable, McClellan Mountain, Aldrich Mountain Roadless and Baldy Mountain Roadless Areas.

Collectively, the Malheur National Forest includes approximately 82, 555 acres of wilderness and approximately 180, 822 acres of roadless areas and these lands are most likely to be used for denning or dispersal. Using the forest GIS habitat layer, potentially suitable den habitat exists on approximately 1,200 acres forest-wide, with 430 acres occurring in more remote wilderness or roadless areas. Of this, almost 80 percent occurs in the Strawberry wilderness. Because deep, persistent snow is characteristic of dispersal habitat (Schwartz et al 2009), wolverine dispersal habitat is more likely to occur on upper elevation ridges and mountains, whereas potential foraging habitat occurs across much of the Forest.

Invasive plants have not been identified as a primary threat to wolverine. Of the 1,200 acres of den habitat, known infestations of invasive plants occur on less than one acre. The low level of invasive weeds is likely a result of the low management/use levels associated with wilderness/roadless areas, although extensive surveys have not been conducted in remote areas of the Forest.

Forest Service (R6) Sensitive Species

Several terrestrial mammals, birds, amphibians and invertebrate species found or suspected to be on the Malheur National Forest are Forest Service Sensitive Species (Table 50, Regional Forester's Sensitive Species List 2011 (USDA Forest Service 2011a)). Management of Forest Service Sensitive Species is a proactive approach for meeting the Agencies obligations under the Endangered Species Act and the National Forest Management Act (NFMA), and National Policy direction as stated in the 2670 section of the Forest Service Manual and the U.S. Department of Agriculture Regulation 9500-4. The primary objectives of the Sensitive Species program are to ensure species viability throughout their geographic ranges and to preclude trends toward endangerment that would result in a need for federal listing. Species identified by the Fish and Wildlife Service as "candidates" for listing under the ESA, as well as species that have been de-listed from ESA are managed as R6 Sensitive Species (USDA Forest Service 2011a). Other species of regional and local conservation concern are also managed as Sensitive Species. This section contains a general description of the species' life history, project area habitat and threats. The two woodpeckers shown below are also Management Indicator Species (discussed in the next section below).

Table 50. Forest Service sensitive species in the project area

Common Name	Scientific Name	Species Status[2]	Project Area Documentation[1]
Mammals			
Gray Wolf	*Canis lupus*	DL east of Hwy 395, S	S
Pygmy rabbit	*Brachylagus idahoensis*	S	S
Townsend's Big-eared Bat	*Corynorhinus townsendii*	S	D
Pallid Bat	*Antrozous pallidus*	S	S
Fringed Myotis	*Myotis thysanodes*	S	S
Birds			
Bald eagle	*Haliaeetus leucocephalus*	DL, S	D
American peregrine falcon	*Falco peregrinus anatum*	DL, S	D
Grasshopper Sparrow	*Ammodramus savannarum*	S	S
Wallowa Rosy Finch	*Leucosticte tephrocotis wallowa*	S	S
Greater Sage Grouse	*Centrocercus urophasianus*	C, S	D
Bufflehead	*Bucephala albeola*	S	D
Upland Sandpiper	*Bartramia longicauda*	S	D
Bobolink	*Dolichonyx oryzivorus*	S	D
Lewis' woodpecker	*Melanerpes lewis*	S,	D
White-headed woodpecker	*Picoides albolarvatus*	S,	D
Amphibians			
Columbia spotted frog	*Rana luteiventris*	C, S	D
Invertebrates			
Shortface lanx	*Fisherola nuttalli*	S	S
Johnson Hairstreak	*Callophrys johnsoni*	S	S
Silver-bordered Fritillary	*Boloria selene*	S	D
Harney Basin Duskysnail	*Colligyrus depressus*	S	D
Columbia Clubtail	*Gomphus lynnae*	S	S

1 – D – species had been recently documented, S-species thought to occur or that may have suitable habitat

2 - C- candidate for ESA listing, DL-delisted from ESA, S-Region 6 Sensitive Species

Gray Wolf

Habitat and Threats - The gray wolf is a habitat generalist inhabiting a variety of plant communities, typically containing a mix of forested and open areas with a variety of topographic features (Verts and Carraway 1998, Witmer et al. 1998). Habitat can include forests of all types, rangelands, brushland, steppes, agricultural lands, wetlands, deserts, tundra, and barren ground areas, although the gray wolf appears to be more prey dependent than cover dependent. Prey species include white-tailed and mule deer, moose, elk, woodland caribou, bighorn sheep, mountain goat, beaver, and snowshoe hare, with small mammals, birds, and large invertebrates sometimes being taken, although ungulates comprise 90 percent or more of their diet (USDI FWS 1987). They are also opportunistic feeders and will prey on carrion when it is available (Witmer et al. 1998).

Wisdom et al. (2000) suggested four major challenges to wolf conservation within the Interior Columbia Basin: excessive mortality from humans, mortality related to roads, displacement from habitat by human activities and population isolation. Consequently the ability of wolves to persist will be determined largely by the degree of human tolerance for the species (Oregon DFW 2005).

Project Area Information - In Oregon, wolves have increased steadily since re-introduction and wolf numbers are currently well above recovery objectives. In northeastern Oregon suitable habitat includes Eagle Cap, Wenaha-Tucannon, North Fork John Day, Strawberry Mountain wilderness areas, Hells Canyon NRA, designated roadless areas on public lands and areas characterized by low density of open roads. Such areas would be characterized as highly suitable because human densities and activity levels are low, whereas ungulate numbers are considered adequate to support wolves (Oregon DFW 2005).

The Idaho wolf population has been increasing steadily, and dispersal into the Blue Mountains is expected to continue (Oregon DFW 2005). In July 2008, a wolf pack that includes both adults and pups was confirmed in a forested area of northern Union county and was the first evidence of multiple wolves and wolf reproduction in Oregon. By the end of 2012, Oregon’s minimum wolf count included 53 wolves including seven packs and at least five breeding pairs. Another breeding pair was added in February 2013 (Oregon DFW 2013b).

While occasional wolf sightings are reported, the gray wolf has not been confirmed within the project area. Wolf sighting information to date seems to indicate transient or lone individuals that are not part of a resident pack. However the project area provides suitable remote forest habitat and supports large populations of big game (Oregon DFW 2005). As a result and considering that a pack has been documented approximately 75 miles northeast in Union county, it is likely that over time wolf use could occur within the project area.

Although foraging or dispersal habitat is relatively widespread, remote habitat suitable for denning or rendezvous sites is restricted to relatively un-roaded areas. Consequently suitable wolf habitat largely occurs within wilderness and roadless areas, which make up almost 263,377 acres on the Forest.

Currently only 16 acres of the wilderness/roadless lands on the Forest have documented infestations of invasive plants. However as described under wolverine, due to the lack of surveys in these remote areas, infestations may be larger than is currently documented. Although not a threat to wolves, invasive plants may adversely affect the quality of habitat for big game populations.

Pygmy Rabbit

Habitat and Threats - Oregon populations of pygmy rabbits are listed as a species of concern under the Endangered Species Act (USDI Fish and Wildlife Service 2013b). They typically occur in areas of tall, dense sagebrush (Artemisia spp.) cover and are highly dependent on sagebrush to provide food, cover and protection from predators throughout the year (USDI Fish and Wildlife Service 2005c, USDI Fish and Wildlife Service 2013b). The winter diet of pygmy rabbits is comprised on up to 99 percent sagebrush.

While big sagebrush is the main food of this species, native grasses and forbs are also eaten in mid-late summer. Also there is evidence that pygmy rabbits prefer native grasses as forage over other foods during this period (USDI Fish and Wildlife Service 2005c).

These rabbits may be active at any time of the day or night, although most activity occurs during mid-morning (USDI Fish and Wildlife Service 2005c). Pygmy rabbits dig their own burrows and need deep loose textured soils for burrow construction, although they occasionally make use of burrows abandoned by other species. As a result they may occur in areas of shallower or more compact soils that support sufficient shrub cover (USDI Fish and Wildlife Service 2013b).

Pygmy rabbits are slow and subject to predation in open areas. Predation is the primary cause of mortality among adults and juveniles and can be as high as 50 percent in the first five weeks of life (USDI FWS b). Accordingly, pygmy rabbits tend to stay close to their burrows and have small home ranges, although home range size and movement distance is variable (U.S. Fish and Wildlife Service 2005c). Loss of sagebrush is the main reason for decline of pygmy rabbit populations (USDA Forest Service 2013b). Agriculture, livestock grazing and associated developments, type conversions of big sagebrush to livestock forage, prescribed and wild fires, invasive plants, and roads also degrade their habitat. The invasive cheatgrass (*Bromus tectorum*) is of particular concern because it invades the understory of big sagebrush shrubs making a critical habitat site unsuitable for the rabbit (Weiss and Verts 1984). Cheatgrass and other invasive plants replace important forage species, introduce a perpetuating fire cycle into big sagebrush habitat (Whisenant 1990), may reduce predator detection, impede movement, and limit dispersal of the pygmy rabbit. McAdoo et al. (2004) stated that weed control is an example of the highest priority habitat treatments for sagebrush-associated wildlife and invasive plants are considered a threat to the rabbit's habitat (USDI FWS 2013b). Finally, due to its dependence on cover and limited dispersal ability, fragmentation of sagebrush habitat is considered a threat to this species (USDI FWS 2005c).

Project Area Information - The project area is near the northern boundary of this species range (USDI FWS 2005c) and historically, pygmy rabbits have been collected from Deschutes, Klamath, Crook, Lake, Grant, Harney, Baker and Malheur Counties in Oregon. However the range of the pygmy rabbit in Oregon may have decreased and boundaries of the current distribution are not known (USGS 2007). Not all potentially suitable sites appear to be occupied and populations are susceptible to rapid declines and local extirpation (Weiss and Verts 1984). Historical and suitable pygmy rabbit habitat was surveyed on State, Bureau of Land Management (BLM) and private land in Malheur, Harney, Lake and Deschutes Counties in 2004/2005 (USGS 2007). Sighting within Harney County indicate that this species occurs mainly in the sagebrush basin south of Burns Oregon. Also an active burrow was documented southeast of Burns, Oregon, approximately 17 miles south of the Forest boundary (USGS 2007).

While there have been no surveys conducted on the Malheur National Forest, and pygmy rabbits have not been documented within the project area, suitable habitat exists. Using GIS and Oregon GAP data for big sagebrush communities, suitable pygmy rabbit habitat was identified and occurs on approximately 24,715 acres within the project area. However it is recognized that this is likely an overestimate of the acres of suitable habitat, since many sites would not have preferred cover and soil conditions. Currently less than 10 acres of invasive plants have been documented in suitable habitat.

Townsend's Big-eared Bat

Habitat and Threats - Townsend's big-eared bats inhabit a wide variety of habitats from old-growth forests to desert. It roosts in caves, mines, rock crevices, buildings, and bridges and hollows of trees, but is primarily cave-dependent. The Townsend's big-eared bat is a moth specialist with over 90 percent of its diet composed of moths. It captures prey in flight or by gleaning from foliage (Csuti et al. 2001). They forage in edge habitats along streams and woodlands, and within a variety of wooded types. They can

travel long distances while foraging, including movements of over 90 miles during a single evening (WBWG 2005).

The primary threat to the Townsend's big eared bat is disturbance and/or destruction of roost sites (e.g. recreational caving, mine exploration, mine reclamation) and studies in Oregon and Washington have reported sizeable reduction numbers due to human visitation and mining (WBWG 2005). Invasive plants are not considered a threat to Townsend's big-eared bats or their habitat.

Project Area Information - Townsend's big eared bats have been documented from all five project area counties (NatureServe 2013). Also they have been recently documented on the Emigrant Creek district, and from caves in Dayville and the John Day fossil beds, approximately ten miles east of the project area (Reames 2013).

Due to the variety of habitat utilized, foraging habitat occurs across the forest, whereas roost and hibernacula occurs in buildings, bridges or other structures scattered across the project area. Suitable Townsend's big-eared foraging habitat includes forested and shrub habitat scattered across the project area, and of this approximately 1,975 acres have documented infestations of invasive plants. Invasive plants do not pose direct threats to this species.

Pallid Bat

Habitat and Threats - The Pallid bat is a year-round resident and most commonly inhabits arid deserts and grasslands often near rock outcrops and water, and is less abundant in conifer and mixed forests. This bat usually roosts in rock crevices or buildings, and less frequently roosts in caves, tree hollows and mines. Oregon night roosts were in buildings, under rock overhangs, and under bridges. It prefers narrow crevices in caves as hibernation and shows strong fidelity to roosts both within and between years (NatureServe 2013). Pallid bats are opportunistic generalists that glean a variety of arthropod prey from surfaces, as well as capture insects on the wing (WBWG 2005). Food items include flightless arthropods, crickets, moths, beetles and may eat small vertebrates (NatureServe 2013, WBWG 2005). They forage over open shrub-steppe grasslands, oak, savannahs, open ponderosa pine forest, talus slopes, gravel roads and orchards (WBWG 2005).

Pallid bats tend to roost gregariously and are sensitive to disturbance. Loss of modification of foraging habitat due to prescribed fire, urban development, agriculture or pesticide use pose potential threats (WBWG 2005). Approximately 1,043 acres of preferred riparian, woodland, shrub and grassland habitats are known to contain invasive plants. Invasive plants do not pose a direct threat to this species.

Project Area Information - The pallid bat has been documented from Haney, Grant and Malheur Counties (NatureServe 2013), including Goose Rocks and the Pallisades (John Day Fossil Beds), approximately 10 miles east of the project area. Suitable cliffline habitat occurs along the Malheur River canyon, Devine Canyon down to Burns, Oregon, along Middle Fork and Coyote Bluff, and this species has been documented at three mine sites in the Vinegar Hill area in 2009 and 2010 (Reames 2013).

Potential roost and hibernacula occur in cliffline habitat along primary river corridors and in buildings or structures scattered across the forest. Pallid bat foraging habitat includes open canopy ponderosa pine stands, woodlands, grassland and shrub habitats, which occur on approximately 361,000 acres across the Forest. Invasive plants have been documented on 428 acres of this. Invasive plants are not a direct threat to this species.

Fringed Myotis

Habitat and Threats - The fringed myotis is a year-round resident in Oregon (NatureServe 2013). While distribution is patchy, it is most common in drier woodlands (oak, pinyon juniper and ponderosa pine), but is found in a variety of habitats including desert scrub, mesic coniferous forest, grassland and sage-

grass steppe (WBWG 2005). This species roosts in buildings, underground mines, rocks, cliff faces, and bridges, although roosting in large decadent trees and snags is common. Maternity roosts are colonial, whereas males are thought to roost singly or in small groups. Hibernation occurs in caves, mines and buildings (WBWG 2005).

The fringed bat feeds on a variety of invertebrate taxa and the relative importance of prey items may vary according to prey availability, geography and season. The two most important items commonly reported in its diet are beetles (*Coleoptera*) and moths (*Lepidoptera)*; however flightless taxa such as crickets and spiders have been reported. This species is adapted to foraging within the forest interior, as well as along forest edges. Modification or loss of roosting habitat is the primary threat, including human impacts to caves and hibernacula as well as reduction in forest and suitable snags. Chemicals that affect bats or their prey are also a threat (WBWG 2005).

Project Area Information - The fringed myotis has been documented from Haney and Grant Counties (NatureServe 2013), including at the Dunstan Preserve (Middle Fork John Day). Due to the variety of habitat utilized, foraging habitat occurs across the forest, whereas roost habitat occurs within mature forested habitat, as well as in caves and buildings and along clifflines. While invasive plants are not considered a direct threat to this species, approximately 2,124 acres of suitable foraging/roost habitat currently contain invasive plants.

Bald Eagle

Habitat and Threats - Bald eagles are protected under the migratory bird treaty act (USDI FWS 2008) and the Bald and Golden Eagle Protection Act (USDI FWS 1999b). Management direction is outlined in the Bald and Golden Eagle Protection Act.

Bald eagles are most common along coasts, major rivers, lakes and reservoirs (U.S. Fish and Wildlife Service 1986), and require accessible prey and trees for suitable nesting and roosting habitat (Stalmaster 1987). Food availability, such as aggregations of waterfowl or salmon runs, is a primary factor attracting bald eagles to wintering areas and influences the distribution of nests and territories (Stalmaster 1987). Bald eagles feed primarily on fish during the breeding season, and eat waterfowl, seabirds and carrion during the winter (U.S. Fish and Wildlife Service 1995).

Bald eagles usually nest in trees near water, but are known to nest on cliffs and (rarely) on the ground. Nest sites are usually in large trees along shorelines in relatively remote areas that are free of disturbance. Adults tend to use the same breeding areas year after year, and often the same nest, though a breeding area may include one or more alternative nests (U.S. Fish and Wildlife Service 1999a). Wintering eagles can be found concentrated at salmon spawning areas and waterfowl wintering areas and a communal winter roost generally hosts several eagles each evening at the same site. Winter roosts also tend to offer more protection from the weather than diurnal roosts (USDI 1986). Isolation is an important feature of winter and night roosts, which are usually located in remote areas with less human disturbance.

A current threat to bald eagles is mortality caused by a new disease, avian vacuolar myelinopathy (AVM) (U.S. Fish and Wildlife Service 1999a). A recent hypothesis implicates a type of cyanobacteria that grows on the invasive aquatic plant, *Hydrilla verticillata* (Wilde 2004). The cyanobacteria are thought to produce a neurotoxin that is fatal to herbivorous birds and their avian predators. Mortalities caused by AVM can have localized impact on bald eagles but there is currently no evidence that the overall recovery of the population is affected (U.S. Fish and Wildlife Service 1999a). The invasive aquatic plant, *Hydrilla verticillata* is not known to occur within the project area.

Bald eagles are still protected by The Bald and Golden Eagle Protection Act, The Lacey Act, and the Migratory Bird Treaty Act, whereas management direction is provided in the National Bald Eagle Management Guidelines (USFWS 2007b). The guidelines contain recommendations for avoiding

disturbance to nesting, roosting, and foraging eagles. Agencies are also directed by the Recovery Plan to address the issues of forested habitat management, prey species management, forest insect risk management, and contingency planning for wildfire risks to eagle habitat.

Project Area Information - The Malheur National Forest has four known bald eagle nest sites, including two nests on the Emigrant Ranger District (Silvies River and Delintment Nests) and two nests on the Blue Mountain District (Galena and Bear Valley). Also two nests occur immediately south of the proclamation boundary on Bureau of Land Management (BLM) administered lands (personal communication between Clark Reams and Howard Richburg 2013). The Silvies River and Delintment Lake territories fall within the Harney Basin/Warner Mountains recovery zone (RZ21), which has a habitat management goal of 16 nesting territories and a population goal of 10 breeding pairs of bald eagles. The Blue Mountain nests fall within the Blue Mountains recovery zone (RZ9), which has a habitat management goal of 14 nesting territories, and a population goal of 8 breeding pairs of bald eagles.

There are four designated bald eagle winter roosts on the Forest (Management Area 5) which total 2,507 acres. Eagles typically arrive in early November and depart about the end of April. The birds often utilize private lands in the valleys during the day and fly to different roost areas on the Forest in the evening. The Rattlesnake and Coffeepot roosts are located on the Emigrant Creek District along the southern edge of the Forest. Roosts on the Blue Mountain Ranger District are on the perimeter of Bear Valley. Winter bird count surveys are conducted annually; the Emigrant Creek roost sites get consistent high use, peaking at about 50 to 70 birds. The Blue Mountain roost sites are used annually but only support a few eagles. The LRMP establishes management area direction for communal winter roost areas, which includes maintaining the integrity of the roost sites, maintaining large diameter trees, and minimizing or avoiding disturbance during roosting periods. Seasonal closures are typically applied to management activities from December 1st through April 1st to help minimize disturbance.

Invasive plants do not pose a threat to the bald eagle. Infestations have been mapped within 3 acres of designated winter roost, and 9 acres of infestations are mapped within one-half mile of the Bear Valley nest.

American Peregrine Falcon

Habitat and Threats - Peregrine falcons that inhabit cliffs located generally within approximately 0.5 miles of riparian habitat (source of prey). Peregrines are aerial predators who feed mostly on birds. Much of the prey consists of species the size of pigeons and doves; however avian prey ranges in size. Disturbance by human activity during the nesting season can cause nest sites and new territories to be abandoned, egg breakage, or diversion of adult attention. Peregrine falcons in the Pacific Northwest are most affected by bio-accumulation of contaminants, and direct disturbance (Pagel 2006). Invasive plants do not adversely affect peregrine falcons.

Project Area Information - While there are no known nest sites, peregrine falcons have been observed on the Malheur National Forest. Use occurs seasonally as individuals migrate through the area in the spring and fall.

In 1992, surveys to identify probable nest sites were conducted on the Malheur National Forest. Cliff systems were rated high, medium or low potential as hack sites or cross-foster locations. Sixteen cliff systems were surveyed. Locations included: Aldrich Mountain, Baldy Mountain, Canyon Mountain, Coyote Bluffs, Fields Peak, Nipple Butte/lake Butte, Malheur River Canyon/Black Canyon, McClellen Creek, Moon Mountain, Riley Creek, Ragged Rocks, Silvies Canyon, and multiple cliff systems in and around Strawberry Lakes. Most of the cliff systems are located along the series of mountain ranges that parallel the John Day Valley on the south side of the valley, primarily the Aldrich and Strawberry Mountains on the Blue Mountain and Prairie City Ranger Districts. Coyote Bluffs and Ragged Rocks are

located in the Middle Fork John Day River drainage on the Blue Mountain Ranger District. Silvies Canyon is located south on the Emigrant Creek District. The Malheur River Canyon cliffs are located on the Prairie City Ranger District. Strawberry Lakes was rated high potential for nesting habitat; Ragged Rocks and Black Canyon were rated medium to high potential. The remaining cliff systems were rated medium to low potential. Sites have been periodically surveyed but no nesting peregrines have been identified at any of the sites.

While there are no nest sites known to occur on the Forest, suitable foraging habitat occurs across the project area.

Grasshopper Sparrow

Habitat and Threats - Although this species has a widespread distribution, it often breeds locally and is considered rare or uncommon in much of its range (Slater 2004). In Oregon it is considered one of the more enigmatic and erratic birds and a small population may appear in an area, persist for a few years, and then disappear, only to return in the future. Suitable habitat in the state is concentrated north of the project area in Morrow, Umatilla and Gillam Counties, although suitable grassland habitat occurs in both Harney and Malheur Counties (OSU 2013).

The grasshopper sparrow is found in a variety of open grassland types, but is area sensitive and large tracks of grassland are more likely to support populations (Slater 2004, PIF 2000, Dechant 2002a). They prefer grasslands of intermediate height and are often associated with clumped vegetation interspersed with patches of bare ground. Other habitat requirements include moderately deep litter and sparse coverage of woody vegetation and shrubs (NatureServe 2013, Slater 2004, Oregon DFW 2013, Janes 1983, Dechant 2002a). In Morrow county the grasshopper sparrow is occurs at low densities and Holmes and Miller (2010) found that grasshopper sparrows were most numerous in perennial grasslands and least abundant in depleted sagebrush and sagebrush/annual grass communities.

The grasshopper sparrow forages almost exclusively on bare ground and eats insects, other small invertebrates, grain and seeds (NatureServe 2013). During the breeding season grasshoppers (*Orthoptera*) have been documented comprising the majority (greater than 60 percent) of their diet, with seeds taken secondarily (Slater 2004). The greatest threats to grassland species such as the grasshopper sparrow include continued habitat loss due to encroachment of woody vegetation (Oregon DFW 2013, Slater 2004), habitat fragmentation and habitat degradation from grazing and fire (Slater 2004). Conservation issues specific to the grasshopper sparrow in the Columbia basin (Altman and Holmes 2000) include; 1) conversion of bunchgrass habitat to agriculture, 2) alteration of bunchgrass habitat from intensive grazing and exotic grass/forb invasions, 3) vulnerability due to agricultural use, 4) shrub encroachment from overgrazing and fire suppression, and 5) early season mowing.

Project Area Information - While the grassland sparrow has not been documented on the Forest, larger grassland habitat greater than 20 acres in size exists on 46,523 acres and of this, 71 acres are infested with invasive plants. However this would be considered an overestimate of suitable habitat because not all acres would have the structural characteristics preferred (i.e. clumped vegetation of intermediate height with patches of bare ground). Also in many areas they have been documented preferring grasslands greater than 75 acres in size (NatureServe 2013).

Wallowa Rosy Finch

Habitat and Threats - This species is restricted to the Wallowa Mountains in Northeast Oregon and winters to West-Central Nevada (Clements 2012). Like *Leucosticte tephrocotis*, the Wallowa rosy-finch breeds on the highest alpine peaks, as well as in barren cirques below timbered peaks on the Wallowa Mountains. Young remain with adults until fall and they move to lower altitudes and latitudes during the winter (OSU 2013). Nests are usually in rock crevices or holes in cliffs. Foraging occurs on the ground

for seeds and in the spring they glean wind-transported insects from snow. Later in the season they may glean insects from vegetation or may chase flying insects in the air (NatureServe 2013). While most high elevation habitats are protected, this species can be most benefitted by monitoring and protection of known sites.

Project Area Information - Habitat locations for this species have not been mapped on the Malheur National Forest. However, habitats are not likely to be infested with invasive plants because they lie in remote, high elevation areas that are distant from primary invasive plant vectors. Thus, potentially suitable habitat is not likely to be infested with invasive plants, and invasive plants are not a direct threat to the Wallowa rosy finch.

Greater Sage Grouse

Status and Habitat Description - A Greater Sage Grouse and Sagebrush Habitat Conservation Team, consisting of state and federal agencies, private landowners, conservation groups and academics, was established in 2001 to craft a comprehensive set of planning guidelines for sage grouse and sagebrush habitats in Oregon. The primary goal of the guidelines is to maintain existing sagebrush-steppe habitats in order to sustain sage grouse populations and protect options for future management.

Sage grouse breed on sites called leks (strutting grounds) in March-April. The same lek sites tend to be used year after year and they are established in open areas surrounded by sagebrush, which is used for escape and protection from predators (Connelly et al. 1991). Optimum sage grouse nesting habitat consists of a healthy sagebrush ecosystem including sagebrush plants and an herbaceous understory composed of grasses and forbs.

Sage grouse nesting and early brood-rearing occurs in April-June, which is considered a critical time for sage grouse. Early brood-rearing generally occurs relatively close to nest sites; however, movements of individual broods may be highly variable (Connelly 1982). Hens with broods tend to select habitats having a wide diversity of plant species that tend to provide an equivalent diversity of insects that are important chick foods. In June and July, as sagebrush habitats dry and herbaceous plants mature, hens usually move their broods to moister sites in or adjacent to sagebrush cover where more succulent vegetation is available (Connelly and Markham 1983, Connelly et al. 1988). Examples of such habitats include low sagebrush (*Artemisia nova; A. arbuscula*) plant communities, wet meadows and riparian areas (Connelly et al. 1988, Connelly and Markham 1983).

Major threats to the species are habitat conversion and degradation. Declines in sage grouse populations have been linked to agricultural conversion, rangeland conversion, livestock management, wildfire, prescribed fire, fire rehabilitation, structure and infrastructure development, juniper expansion, and invasions of exotic species (Blus et al. 1989; Braun 1987, Braun 1998, Connelly et al. 2000, Quigley and, Swensen et al. 1987, Wisdom et al. 2000, USDI Fish and Wildlife Service 2003c).

Cheatgrass (*Bromus tectorum*) invasion has particularly degraded sage grouse habitat by and altering fire cycles in the sagebrush-steppe ecosystem (Crawford et al. 2004). The presence of cheatgrass fills in voids between shrubs and will carry frequent fires in the same areas. The frequent fires prohibit re-establishment of the big sagebrush and create cheatgrass monocultures that are unsuitable for sage grouse. Additional threats include herbicide and insecticide use (Crawford et al. 2004). Insecticide application to alfalfa fields in Idaho resulted in mortality to sage grouse that fed on contaminated insects (Blus et al. 1989, Connelly and Blus 1991). Herbicides were commonly used in sage grouse habitat until the1980s to reduce cover of sagebrush and increase livestock forage and these habitat alterations created areas unsuitable for sage grouse.

Project Area Information - The largest sagebrush habitats are located on the Emigrant Creek and Prairie City Ranger Districts, particularly along the southern boundary of the Forest where sagebrush shrublands

extend off the Forest and on to BLM lands. Habitat on National Forest System land is often considered marginal when compared to larger expanses of habitat located on Bureau of Land Management (BLM) and private lands to the south of the Forest and in larger valleys such as Bear Valley and Silvies Valley. On the northern half of the Forest, sage brush habitats are small and highly fragmented. There have been incidental sightings of sage grouse on the Forest, but sightings are uncommon. There are no documented leks or key brood-rearing habitat identified. Sage grouse use appears to be occasional and random within suitable habitat.

In 1993, Oregon Department of Fish and Wildlife (ODFW) biologists estimated that Bear Valley had about 60 birds and a stable population. In 2003, ODFW revised the 1993 estimates and believe grouse populations in Bear Valley may have declined, primarily due to predation (coyotes), but also because of livestock grazing and agricultural conversion. Approximately 139,500 acres of suitable habitat have been mapped on the Malheur National Forest and 79 acres of invasive plants have been mapped within this habitat.

Bufflehead

Habitat and Threats - The bufflehead is a tree-nesting, diving duck whose population has declined throughout some of its range (Marshall et al. 2003). For nesting, it uses mountain lakes surrounded by woodlands with snags (mostly aspen, but it will use ponderosa pine and Douglas-fir). Buffleheads are common in parts of Oregon and Washington during winter, but are rare during the breeding season. Buffleheads eat animal matter, with common diet items including aquatic insects and larvae, physid snails, fish and sometimes herring eggs or salmon carrion. They also eat seeds of aquatic plants, such as smartweed, alkali bulrush, and sago pondweed (Marshall et al. 2003). Although no threats to buffleheads were identified, the lack of suitable breeding habitat (tree cavities adjacent to lakes) would be limiting in many areas.

Project Area Information - Although breeding has not been documented in eastern Oregon, the Forest provides stopover habitat during migration and buffleheads have been documented adjacent to the Forest in Bear Valley. Suitable habitat includes Forest lakes and wetlands, which occur on approximately 350 acres Forest-wide and these areas could be used as “stopover” habitat during migration. Currently less than an acre of suitable Bufflehead habitat is known to be infested with invasive plants. Invasive plants have been identified as a threat to waterfowl (Blossey 1999).

Upland Sandpiper

Habitat and Threats - Upland sandpipers are a rare breeder in large montane meadows within forests of eastern Oregon and are almost never observed away from their breeding grounds (Oregon DFW 2013). They generally nest in extensive, open tracts of short grassland habitat, including native prairie, dry meadows, pastures, domestic hayfields, and short-grass savanna, plowed fields along highway rights-of-ways and on airfields. Preferred habitat includes large areas of short grass for feeding and courtship with interspersed or adjacent taller grasses for nesting and brood cover (Dechant 2002b).

In the Blue Mountains, upland sandpiper habitat is large flat or gently rolling expanses of grassland in mountain valleys and open uplands with small creek drainages and wet to dry meadows. Use areas have a wide diversity of plants, and forb abundance is particularly important. Occurrence of upland sandpipers is positively correlated with patch size and they often utilize meadows which are generally at least 125 acres in size. They selectively nest where the vegetation is between 6 and 13 inches tall and avoid fields containing relatively uniform stands of grass, tall undisturbed stands of grass, or those seeded to smooth brome. Upland sandpipers have strong site fidelity, returning to the same area about the same time each year. Other key habitat features near nest sites are loafing and feeding areas that have shorter, sparser vegetation than nesting areas and the proximity of a small shrub or tree. Sandpipers are very secretive and easily disturbed by humans (Altman 2000).

Upland sandpipers feed primarily on insects, but also eat ants, berries, and seeds of grasses and forbs (Csuti et al. 2001). They prefer upland sites that have higher soil moisture than adjacent areas and foraging sites often had surface water during spring. A moderate threat to upland sandpiper habitat exists from declines associated with plowing of natural grasslands, degradation and fragmentation of habitat due to increased urbanization, farming practices and forest succession (NatureServe 2013).

Project Area Information - From the 1980s through 1991, numbers in Oregon were the largest population of nesting sandpipers west of the Rockies. Seven locations make up the Oregon population, and two of those areas are Bear Valley and Logan Valley on the Malheur National Forest. In Bear Valley and Logan Valley, numbers of nesting upland sandpipers have been declining since mid-1980s.

Bear Valley and Logan Valley locations accounted for over half of the sandpipers in the state in 1984, when 23 pair (7 nests) and 3 singles were found in Bear Valley, and 12 pair (2 nests) and 6 singles were found in Logan Valley. Nests have been found along ditches or near moist areas, often adjacent to sagebrush. Both Bear Valley and Logan Valley have areas of short grasses mixed with forbs and scattered sagebrush patches. The removal of sagebrush and the seeding of non-native grasses have altered the habitat in Bear Valley east of Highway 395, where upland sandpipers nested in the 1980s. Although bird numbers have declined, management has not changed in the rest of Bear Valley, which contains the majority of the occupied habitat. Logan Valley management has apparently changed and lodgepole pine has encroached in the valley. Water regimes and drainage patterns have also changed which have affected the character of the habitat

Potential upland sandpiper habitat includes all grassland and shrubland habitat that is 125 acres in size or more and on slopes of less than 25 percent (Dechant 2002b). Approximately 78,669 acres exist Forest-wide, although due to the height and structural preferences, preferred habitat would be less. Of the larger grassland/shrub habitats that provide potentially suitable habitat 72 acres are currently infested with invasive weeds.

Bobolink

Habitat and Threats - The bobolink is a bird of open prairies, grasslands, wet meadows, pastures, and grain crops. In Oregon, there are only a few disjunction populations that breed in irrigated hay meadows fringed with willows or in wet, grassy meadows with local growths of forbs and sedges. Many of these areas are mowed and/or grazed, which facilitates nesting of bobolinks. Bobolinks eat grass and forb seeds as well as insects. During the breeding season, more insects are included in the diet, especially caterpillars. Keys to management are to provide large areas of suitable habitat (native and tame grasslands of moderate height and density with adequate litter, controlling succession, and protecting nesting habitat from disturbance during the breeding season (early May to mid-July) (Dechant et al. 2001).

Project Area Information - Limited habitat exists in areas that have grasslands, wet meadows, willows or other water-loving shrubs. Oregon GAP data was used to identify potential bobolink habitat, which includes all, grasslands, wetlands, wet meadows and willow bottoms. These areas total 17, 080 acres and 50 acres of invasive plants are known to occur on these lands.

Lewis' Woodpecker

Status and Habitat Description - Breeding habitat includes open forest and woodland, often logged or burned, including oak, coniferous forest (primarily ponderosa pine), riparian woodland and orchards and less commonly pinyon-juniper (Millen-McLean 2012d, NatureServe 2013). Important habitat features include an open tree canopy, a brushy understory with ground cover, large dead trees and downed woody debris (DWD). They prefer open ponderosa pine at high elevations and open riparian vegetation at low elevations (NatureServe 2013, Altman and Holmes 2000, Thomas et al. 2009).

Unlike other woodpeckers, this species seldom excavates its own cavity for nesting and greatest densities often occur in areas of high snag density, such as burned areas (Mellen-Mclean 2012a), In late summer, wandering flocks move from valleys into mountains and in winter this species uses oak woodlands and fruit orchards. Lewis' woodpeckers feed on adult emergent insects in summer and ripe fruit and nuts in the fall and winter. Unlike other woodpeckers, this species does not bore for insects but will take insects aerially (hawking), glean insects from tree branches or trunks, or drop from perch to capture insects on the ground (NatureServe 2013). Within the Columbia Plateau, historical levels of source habitat have declined by 95 percent (Altman and Holmes 2000) and this species has been locally extirpated in parts of its range (Altman et al. 2000).

Project Area Information - While the Lewis' woodpecker has been documented from three counties within the project area (Grant, Crook and Baker) (NatureServe 2013), most of the existing sightings have occurred in burned areas. However scattered sightings have also occurred within ponderosa pine woodland and cottonwood riparian communities in the northern portion of the project area. Habitat for this species was identified by looking at; dry ponderosa pine with large snags and open canopies, cottonwood/willow communities, and more recent post fire (since 1990) habitat.

Currently approximately 275 acres of invasive plants have been mapped within the 311,700 acres of post-fire suitable habitat. Invasive plants are not considered a direct threat to forested habitat preferred by this species.

White-heated Woodpecker

Habitat and Threats - White-headed woodpeckers occur mainly in open ponderosa pine or mixed-conifer forests dominated by ponderosa pine, usually in old-growth or in stands with old-growth components. They excavate cavities in snags and also stumps, logs, and dead tops of live trees. Pine seeds are a major part of its diet in the fall and winter, although they also probe, glean, and pry off loss bark for insects and catch insects in the air. Over the course of the year, pine seeds and insects make up 60 percent and 40 percent of its diet respectively (NatureServe 2013). Populations in Oregon are decreasing due to fragmentation and a loss of forest cover (Audubon 2013).

Project Area Information - The white-headed woodpecker is currently documented from over 60 locations across the forest with nesting confirmed in the ponderosa pine woodland community. Habitat for this species was identified by selecting dry ponderosa, Douglas fir and dry pine communities with an open canopy (10-40%) and tree sizes greater than or equal to 21 inches d.b.h. Using this criteria there are currently 21,509 acres of white-headed woodpecker habitat scattered across the project area. Of this acreage, invasive plants are known to occur on approximately 10 acres. Invasive plants are not considered a direct threat to forested habitat preferred by this species.

Columbia Spotted Frog

Status and Habitat Description - The Great Basin Distinct Population Segment (DPS) of the Columbia spotted frog is a federal candidate species and is found in Oregon, Idaho, and Nevada. It has been documented on the Malheur, Ochoco, Umatilla, and Wallowa-Whitman National Forests. Columbia spotted frogs are highly aquatic and usually stay near permanent, quiet water along the grass and sedge margins of streams, lakes, ponds, springs, and marshes. Breeding habitats include a variety of relatively exposed, shallow-water (less than two feet), emergent wetlands such as sedge fens, riverine over-bank pools, beaver ponds, and the wetland fringes of ponds and small lakes. Vegetation in the breeding pools generally is dominated by herbaceous species such as grasses, sedges and rushes and froglets and adults live in well-vegetated ponds, marshes or slow, weedy streams that meander through meadows (Corkran and Thomas 2006). Springs may be used as over-wintering sites for local populations (Hayes et al. 1997). After breeding, adults often disperse into adjacent wetland, riverine and lacustrine habitats. Columbia spotted frogs are capable of long movements, including across uplands (Bull and Hayes 2001).

Larvae have a diet of algae, plant material, and other organic debris. Adults eat insects (ants, beetles, mosquito larvae, and grasshoppers), spiders, mollusks, tadpoles, crayfish, and slugs; arthropods, earthworms and other invertebrate prey (NatureServe 2013, Hayes et al. 1997, Csuti et al. 2001). Threats to the species include mining, livestock grazing, road construction, agriculture, and direct predation by bullfrogs and non-native fishes. Also environmental stressors such as pesticides, herbicides, fertilizers, and heavy metals may slow reactions or cause behavioral changes that make spotted frog tadpoles more vulnerable to predation (Lefcort et al. 1998, Rosenshield et al. 1999, Marco et al. 1999, Bridges 1999b, Bridges and Semlitsch 2000).

Project Area Information - Columbia spotted frogs are believed to be in all sub-basins of the project area and this species is often found in natural ponds and lakes, rock pits, old mining ponds, livestock stockponds, and slow moving streams that retain water year-round. Spotted frog surveys have been conducted periodically since the 1980's, and although not all areas of the Forest were surveyed, they did confirm that the species is fairly well distributed, but occurs at low levels. Most spotted frog sites found on the Forest have been found in small pools along perennial streams or in mining ponds and small lakes. Suitable breeding habitat was estimated using existing wetland habitat, sedge meadow habitat from Oregon GAP data and all lands within 300 feet of forest water bodies and springs. This totals approximately 58,700 acres and has 52 acres of documented invasive plants. This species could be affected by invasive plants, especially in wetland habitats.

Shortface Lanx

Status and Habitat Description - This species is sporadically distributed in the Columbia River and a few major tributaries in Oregon, Washington, Montana and Idaho. In Oregon, healthy populations of shortface lanx persist in the Deschutes River and smaller populations occur in the John Day and Imnaha Rivers (USDA Forest Service 2010a).

Shortface lanx are a non-migrant freshwater snail that can be found in the main channel of fast flowing streams and rivers. Habitat includes unpolluted, cold, well oxygenated streams and rivers between approximately 100 ft. and 300 ft. in width. They feed by scraping algae and diatoms from rock surfaces and require streams/rivers with a cobble/boulder substrate (USDA Forest Service 2010a). Habitat loss and pollution are the primary threats to this species. Populations have been lost from most tributaries and almost all the Columbia River due to impoundments and the loss of rocky substrate (USDA Forest Service 2010a)

Project Area Information - In Oregon the shortface lanx has been documented on the Wallowa Whitman National Forest and is suspected on the Malheur and Ochoco Forests (USDA Forest Service 2010a). Suitable habitat includes approximately 16 miles of river habitat associated with the John Day and Malheur Rivers. Invasive plants are not considered a direct threat to this species, and there are no documented invasive plants within 100 feet of suitable habitat.

Johnson Hairstreak

Status and Habitat Description - Scattered sightings have been reported in Oregon in the Cascades Coast Range, Siskiyou Mountains, Blue Mountains and Wallowa Mountains (USDA Forest Service 2011b) and are associated with old growth and mature forests. Habitats include clearings among conifer forests, especially mature ponderosa pine, although lodgepole pine, true fir, Douglas fir and western larch are also utilized (Pyle 2002). Larvae feed exclusively on aerial shoots of dwarf mistletoe (*Arceuthobium* species) and adults feed on the nectar of flowers in several families. All sightings in Washington and Oregon have been in coniferous forests (Pyle 2002).

Threats to this species include habitat loss, pesticides such as *Bacillus thuringiensis* and herbicides which are applied to flowering plants which this species visits. Also there is some evidence of hybridization with the thicket hairstreak (*C. johnsoni*) (USDA Forest Service 2011b).

Project Area Information - While there have been no surveys on the Forest and this species has not been documented, Johnson's hairstreak has been documented from Baker County (Oregon Biodiversity 2010) and use is possible. While suitable habitat for this species was not identified, it could occur in coniferous forest containing host plants. Invasive plants are not considered a direct threat to habitat for this species.

Silver Bordered Fritillary

In Oregon these butterflies have been found in Big Summit Prairie in Crook County, from the Strawberry Mountains in Grant County and from Baker County (USDA Forest Service 2010b, Oregon Biodiversity 2010). Habitat for this species can be found in bogs, open riparian areas, and in marshes containing large amounts of Salix and larval food plants (Warren 2005 In USDA Forest Service 2010b). Adults lay eggs on or near violets, usually marsh violet (*Viola palustris*) and bog violet (V. *nephrophylla*), whereas adults feed on nectar of various composites including mint and Verbena. Sunny habitat encourage adult flight and in Baker County annual broods are likely to occur from mid to late May, whereas Grant County populations fly between early June and Mid-August (USDA Forest Service 2010b).

The silver-bordered fritillary is dependent upon maintenance of wet meadow habitat and its associated food plants. Downcutting of creeks and subsequent draining and drying out of meadow habitat, due in part to loss of beaver populations, loss of native plant species due to livestock grazing and invasion of non-native grasses are threats to this species.

Project Area Information - While not documented on National Forest System lands, silver-bordered fritillary have been documented on adjacent private land and use of suitable wet meadow habitat on the forest is likely. Suitable habitat includes riparian/wetland non-forest communities identified from the forest wetland and vegetation GIS layers, combined with Oregon GAP wet/sedge meadow habitat. Currently there are approximately 22,100 acres of potentially suitable habitat and of this 34 acres are known to contain invasive plants.

Harney Basin Duskysnail

Status and Habitat Description - To date in Oregon this species is only documented from the Silvies River drainage in Harney County and from the Fremont Winema National Forest in Lake County (USDA Forest Service 2013). Little is known about the feeding habitats, growth, reproduction, or life span of this recently described species and hydrobiidae snails, in general feed on algae, diatoms, and detritus. Habitat includes shallow, cold springs and runs at elevations between approximately 4,480 ft./ and 4.670 ft. with surrounding vegetation of sage scrub (Deixis MossuscDB 2009, Hershler 1999 In USDA Forest Service 2013). While abundance estimates of this species have not been conducted, the Forest Service noted very high abundance at one large spring site and most rocks had many snails attached, and thousands of individuals were thought to be present (2013).

Any modification of the cold-water spring environment where this species lives could be a potential threat to its survival. A number of habitat threats have been identified for this species including; livestock grazing, water and site degradation associated with recreation, and wildfire and retardant chemicals. Conservation strategies include protecting known sites and maintenance of water quality and substrate conditions (USDA Forest Service 2013).

Project Area Information - This species has been documented on the Malheur National Forest and is suspected on the Ochoco National Forest and on adjacent BLM land (USDA Forest Service 2013). The Malheur National Forest site (Spring Creek) where this species occurs is a large cold water perennial

spring flowing out of a lava cliff. The springs create a fast, cold flow, are about 15 ft. wide and one to eight inches deep. Fish are present and yellow monkey flower (*Mimulus* sp.) water cress (*Nasturtium* sp.) and other aquatic and riparian plants are prevalent. This relatively large spring is one of a series of smaller springs in the area, and appears to be a secure habitat for this species due to lava boulder field offering protection from grazing; however, part of the site is a favorite local recreational site that receives a high level of riparian disturbance and recreation in the creek (USDA Forest Service 2013).

There are no known invasive plants at the Spring Creek site, although invasive plants are mapped in the surrounding watershed. Invasive plants are not considered a direct threat to this species.

Columbia Clubtail

Status and Habitat Description - In Oregon the Columbia clubtail is known to occur over a somewhat short stretch (about 15 miles) of the John Day River in Wheeler and Grant Counties and from a single location on the Owyhee River near Rome in Malheur County. Although this dragonfly is fairly common in areas where it is found, it has one of the most restricted ranges of any North American odonate (USDA Forest Service 2012). This non-migratory dragonfly can be found in a variety of river habitats, which can range from sandy or muddy to rocky, shallow rivers with occasionally gravelly rapids. Water flow tends to be slow moving and larval river habitat is most critical. Eggs are laid in the water and after hatching; larvae burrow in the mud and overwinter. After emerging from the water, adults forage among shrubs from mid-June to mid-August (USDA Forest Service 2012). Threats include activities that affect siltation or runoff and introduction of predatory fish (ibid.).

Project Area Information - While not documented on the Forest, it has been documented below the Forest boundary in the John Day River and suitable habitat is present. Forestwide there are approximately 100 miles of riverine habitat which may provide breeding and winter habitat. There are currently 51 acres of invasive plants within 300 feet of Forest riverine habitat. This species is not adversely affected by invasive plants.

Management Indicator Species

Management Indicator Species (MIS) are selected species whose welfare is believed to be an indicator of the welfare of other species using the same habitat, or a species whose condition can be used to assess the impacts of management actions on a particular area (Thomas et al. 1979). Management Indicator Species on the Forest are identified in table 51 and are grouped into three categories including 1) big game (commonly hunted species), 2) old growth, and 3) primary cavity excavators (PCE's). The following section discusses MIS by the habits they represent

Table 51. Management Indicator Species on the Malheur NF and Ochoco NF

Species	Representing	Habitat/Indicator
Rocky Mountain Elk	Big Game/commonly hunted species	General forest habitat conditions and winter range.
Pileated Woodpecker	Old Growth, Primary Cavity Nester, snags and downed wood	Late-successional coniferous forests with dense canopy, high basal area, and large diameter snags.
Pine Marten	Old Growth	Mature and old growth mesic coniferous forest with high structural diversity in the understory.
Three-toed Woodpecker	Old Growth	Old Growth Lodgepole Pine
Primary Cavity Excavators	Snags and downed wood	Dead/down(snag) habitat.
Northern Flicker	Primary Cavity Nester	Old Growth juniper.

Big Game

Rocky Mountain Elk - Rocky Mountain elk was selected as an indicator species in the Forest Plan to represent general forest habitat and winter ranges. Concern over this species arises from its status as an important game species. Habitat quality for elk is evaluated in terms of forage, cover (satisfactory and marginal), elk screening, and open road density. The Habitat Effectiveness Index (HEI) model, (Thomas et al. 1988) will not be applied here because the model is not a suitable tool for evaluating invasive plant management effects on elk. In addition, there would be no change in cover or road density; therefore the habitat effectiveness index would not change from the existing condition due to management of invasive species. There is the potential to increase forage; however no treatment area is large enough to meaningfully change the habitat effectiveness index.

The quality of elk habitat is influenced by the presence of humans, which causes animal stress and hunting vulnerability. This is primarily associated with motorized use of open roads and the availability of vegetation (live and dead) to screen elk. Elk have been found to select habitats preferentially based on increasing distance from open roads (Rowland et al. 2000). Vulnerability and hunting mortality have been found to be higher in forested stands with greater road densities and less vegetation to provide screening (Weber et al. 2000).

Elk habitat on the Forest was mapped as part of a cooperative effort sponsored by the Rocky Mountain Elk foundation. This effort concluded that the project area contains an estimated 624,673 acres of elk winter range, whereas the entire forest is used during the summer. Invasive plants have been documented on approximately 582 acres of the forest winter range and 2,124 acres of elk summer range. Of this, 517 acres (89 percent) of the winter range infestations and 1,860 acres (88 percent) of the summer range infestations are adjacent to roads. Approximately 500 acres of elk-calving habitat also occur on the Malheur National Forest, although there are currently no known invasive plants on these lands.

Invasive plant management is not expected to impact Oregon State Management Objectives or hunting permits at this time. However, invasive plants probably affect deer and elk more than any other species analyzed in this section and can out-compete and replace native forage plants for these ungulates. Consequently eradicating, controlling and/or containing invasive plants would improve elk and deer habitat.

Old Growth

Forest LRMP management area 13 (MA-13) provides for the management of old growth through a network of dedicated old growth (DOG) areas and replacement old growth (ROG) areas. Forestwide, a total of 104,453 acres occur in the DOG/ROG network, which is managed in part to provide habitat for old growth MIS, including the pileated woodpecker, pine marten and three-toed woodpecker. There are 98 acres of invasive plants known to occur within the Forest DOG/ROG network.

Pileated Woodpecker - Pileated woodpeckers prefer late successional stages of coniferous or deciduous forest. Because they nest in large diameter snags, roost in large diameter hollow trees and use large logs and snags for foraging, pileated woodpeckers are associated primarily with older stands. Approximately 80 percent of the pileated woodpecker foraging in northeastern Oregon occurs in dead trees and dead and down logs (Mellen-Mclean 2012a).

The pileated woodpecker is fairly common throughout the Malheur National Forest in mature and late-successional mixed-conifer forest and this species is documented in suitable habitat across the Forest. Forest-wide pileated woodpecker habitat was identified using two sources including old growth stands that are being emphasized for pileated woodpecker habitat, as well as stands that have the species and structural conditions characteristic of nesting, roosting and foraging (i.e. multi-story stands (OFMS), including an average overstory diameter of 20 inches d.b.h. or greater. There are approximately 224,197

acres of suitable pileated woodpecker habitat forestwide and of this invasive plants are known to occur on 247 acres. When looking only at pileated woodpecker habitat within MA 13 old-growth areas (e.g. DOGs and ROGs), suitable habitat exists on approximately 87,880 acres and of this, approximately 78 acres are known to contain invasive plants.

Pine Marten - Pine (American) marten have a wide distribution across the western and eastern portions of the Blue Mountains and are year-round residents of the Blue Mountains (Mellen-McLean 2012b). Pine marten are typically associated with late-seral coniferous forests characterized by closed canopies, large trees, and abundant standing and downed woody material. Of particular importance is the quantity of downed debris on the forest floor as it provides protection from predators, access to the under snow environment for hunting and resting, and thermal protection from heat and cold (Ruggiero et al. 1994). Marten also show a strong preference for riparian habitat (Baldwin and Bender 2008).

They eat a variety of small mammals, particularly squirrels, as well as voles, mice, pika, and rabbits and do not tolerate concentrated human use or habitat modification (Maser et al. 1981).

The historical and current density and distribution of marten in the Forest is unknown, but they are thought occur in low numbers. Suitable pine marten habitat occurs on 314,134 acres across the project area and includes primary habitat or multi-structure forest greater than 20 inches d.b.h., as well as secondary habitat, or multi-structure forest between 15 inches and 20 inches d.b.h. Of the total habitat, 355 acres currently have invasive plants. Approximately 15,523 acres of old growth lands (DOGs and RPGs) within the project area are managed for pine marten, and invasive plants are known to occur on approximately 18 acres within these habitats. Invasive plants do not pose a direct threat to this species or its habitat.

Three-toed Woodpecker - The tree-toed woodpecker is an indicator for lodgepole pine and mixed conifer forests. Primary habitat includes higher elevation lodgepole pine, fir/hemlock and Douglas-fir mixed (Marshall et al. 2003). They are associated with mature and overmature stands with elevated levels of dead and dying wood associated with insect and disease related mortality or stand replacing wildfire (Wisdom et al. 2000). They are locally abundant in areas of insect outbreaks and their populations are irruptive as they follow outbreaks across the landscape. When available post fire habitat is preferred, although numbers of nests decrease between three and five years post fire. They specialize on bark beetles (*Scolytidae*) versus the black-backed woodpecker which specializes on wood boring beetles (*Cerambycidae)* (Leonard 2001).

Potentially suitable habitat was identified by taking stands with a higher density of snags greater than 10 inches d.b.h. of preferred nesting and foraging cover types (Mellon-Mcleanon 2012c) and recent post-fire habitat. Approximately 360,000 acres of suitable habitat exists and of this, 428 acres are currently infested with invasive plants. No invasive plants have been mapped within the 631 acres of old growth habitat managed for this species. Invasive plants do not pose a direct threat to this species.

Primary Cavity Nesters (Snags and Dead Wood)

Primary cavity excavators include Lewis' woodpecker, yellow-bellied sapsucker, red-breasted sapsucker, Williamson's sapsucker, downy woodpecker, hairy woodpecker, white-headed woodpecker, three-toed woodpecker, black-backed woodpecker pileated woodpecker and northern flicker. Table 52 identifies preferred habitat for those species not discussed above as MIS or sensitive species, whereas a discussion of suitable habitat for these species is below. Collectively these species utilize a variety of habitats, although they all depend upon dead trees and down logs for reproduction and foraging.

Virtually all of the forested land provides potentially suitable habitat because primary cavity nesting species utilize a wide variety of snag species and size classes. Although native plant infestations occur

within sites containing snags, because invasive plants don't affect standing dead or downed wood habitat, they are not adversely affecting cavity nesting species or their habitat.

Table 52. Habitat for Cavity Nesters (MIS)

MIS Cavity Nesting Species	Habitat
Red-naped Sapsucker	Riparian habitat, especially aspen, cottonwoods and pine forest communities.
Red-breasted Sapsucker	Mature moist coniferous and mixed deciduous-coniferous forest. Typically nest in large trees.
Williamson's Sapsucker	Open, late-successional lower montane forests (Douglas fir, western larch, grand fir, white fir and ponderosa pine) and aspen and cottonwood stands with high densities of snags.
Downy Woodpecker	Riparian habitat and lowland deciduous forest at low to mid elevations consisting of a mixture of grasses, shrubs and hardwoods.
Hairy Woodpecker	Ponderosa pine forest at low to mid elevations with trees 10 to 20 inches diameter.
Black-backed Woodpecker	Post fire habitat and forest with insect and disease related mortality. Associated with high densities of smaller diameter snags (9 to 15 inches d.b.h.
Northern Flicker	Habitat generalist that prefers open areas such as open woodlands, meadows, fields and regeneration sites. Nests in large snags.

Red-naped and Red-breasted Sapsucker - Source habitat for the red-naped sapsucker consists of riparian habitats, especially aspen, cottonwoods, alder and pine, although habitat is less abundant in mixed conifer forest (Marshall et al. 2003, Wahl et al 2005). Nest trees are most common aspen with heart rot, but ponderosa pine are also selected. Red-naped sapsuckers are considered common within suitable habitat across the Forest.

Williamson's Sapsucker - In northeastern Oregon, this species occurs in mature and old-growth mixed-conifer forests at approximately 3,500 to 6.500 ft. in elevation. Preferred habitat is comprised of open, later seral stages of montane and lower montane forest (Douglas fir, western larch, grand/white fir, ponderosa pine, aspen and cottonwood) (Wisdom et al 2000, Wahl et al 2005, Marshall et al 2003). Both live and dead trees are used for nesting, although snags are a critical component of breeding habitat (Bull et al. 1980). Williamson's sapsuckers feed at sapwells in ponderosa pine and Douglas-fir and glean insects from the bark of trunks and limbs (Marshall et al 2003). Home range size is estimated at 10 to 22 acres (Johnson and O'Neil 2001). Williamson's sapsuckers are fairly common across the Forest.

Downy Woodpecker - In Oregon the downy woodpecker is widely distributed in low to moderate elevation habitat deciduous riparian woodlands and lowland deciduous forest (Marshall et al 2003). These woodpeckers are also found in parks and orchards. Territory size ranges from five to nine acres and nesting occurs in trees and snags greater than eight inches d.b.h. Downy woodpeckers have been documented across the Forest.

Hairy Woodpecker - Habitat for this species includes dry and wet coniferous forest at low to mid-elevations, as well as deciduous forest and riparian areas. The hairy woodpecker uses all ages of forest, although older stands are often preferred for nesting. Nesting occurs in moderately decayed snags, primarily in ponderosa pine trees between 10 and 20 inches d.b.h. Highest densities occur in un-salvaged forests and recent (1 to 5 years) post-fire habitat with moderate to high densities of snags. Older burns do no support high levels of wood-boring beetles used for foraging (Saab et al. 2007). Home range size has been reported at between 22 and 37 acres (Marshall et al. 2003). This species is frequently detected at point count surveys across the Forest.

Black-backed Woodpecker - This species is largely restricted to post fire habitat (Saab and Dudley 1998). In the Blue Mountains it is associated with high elevation boreal and montane coniferous forest, especially recent (less than five years) post-fire habitat (Dixon and Saab 2000). However it is occasionally observed in mixed conifer, lodgepole pine, and Douglas fir and spruce fir forests (Hutto 1995). Observations of this species on the Forest occur primarily in areas of large stand-replacing wildfires.

Northern Flicker - The northern flicker is a common resident woodpecker in Oregon. It is a habitat generalist, although is most abundant in open forests and forest edges. This species utilizes coniferous and deciduous forest, riparian woodlands and urban areas (Marshall et al. 2003, Wahl et al. 2005). Nesting typically occurs in open areas with snags that exhibit some decay and Marshall et al. (2003) found that 71 percent of the nest trees had broken tops. Northern flickers are detected on a fairly regular basis during breeding bird surveys across the Forest, particularly in post-fire habitat.

Featured Species

Featured species identified in the Malheur and Ochoco Forest Plans include species that require special protection. These species and their preferred habitat are displayed in table 53. Some of these species have already been discussed and narrative affected environment discussion is not repeated here.

Table 53. Habitat for Featured Species

Featured Species	Habitat
Northern Goshawk	Mature mixed conifer forest with predominantly closed-canopy conditions for nesting and a diversity of forest and non-forest conditions for foraging
Blue Grouse	Coniferous forests (Douglas-fir, grand fir, subalpine fir) with a mixture of deciduous trees and shrubs near edges and clumps, and mistletoe infected Douglas-fir located on ridge tops or upper slope positions
Sage Grouse	See Sensitive Species Section.
Osprey	Large, old trees with dead tops or large snags suitable for nesting adjacent to large rivers or lakes.
Pronghorn Antelope	Open grasslands with low sagebrush being an important component.
California Bighorn Sheep	Alpine desert grasslands associated with mountains, cliffs, foothills and river canyons.
Upland Sandpiper	See Sensitive Species Section.

Northern Goshawk

The northern goshawk can be found in landscapes that contain large blocks of mature forest, large trees for nesting and abundant prey (squirrels, grouse, hares, larger songbirds). They use broad landscapes that incorporate multiple spatial scales including more closed-canopy stands for nesting and foraging and post-fledging habitat (PFA). Nest stands are typically composed of large trees, closed canopies and multiple canopy layers (McGrath et al. 2003, Reynolds et al. 1982), whereas PFAs typically include a variety of forest types and conditions, including young forest and openings (Reynolds et al. 1992). Goshawks are classified as prey generalists (Squires and Reynolds 1997) and forage for small birds and mammals in open understories below the forest canopy and along small forest openings (Reynolds et al 1992). Foraging areas are usually more open than nesting areas, but would contain large trees, snags, down logs, vegetative layering, and other structural elements important to prey species (Reynolds et al. 1992).

There are 142 goshawk nests and associated post-fledgling areas across the Forest. Nesting and foraging habitat occurs on approximately 400,700 acres; invasive plants have been mapped within about 567 acres

of these habitats. Post-fledgling areas cover approximately 27,000 acres; invasive plants have been mapped within 18 acres of this habitat. Because of its preference for closed-canopy forest, invasive plants are not considered a direct threat to the goshawk.

Blue (Dusky) Grouse

Blue grouse prefer coniferous forest (Douglas fir, grand fir and sub-alpine fir) with a mixture of deciduous trees and shrubs near edges and openings and feed and nest in a variety of forest and shrub vegetation types. They utilize large, mistletoe infected Douglas fir trees, generally located within the upper third of slopes as winter roosts, whereas dense coniferous thickets of small trees, stumps, and down logs are used by blue grouse for resting, drumming and escape cover. They also utilize dense deciduous areas in riparian corridors. Blue grouse home ranges are typically 1.25 to 5 acres, and are usually associated with openings and rocky areas. The food items of blue grouse vary from a simple winter diet of primarily coniferous needles to a summer diet consisting of a variety of green leaves, fruits, seeds, flowers, animal matter and conifer needles. While vegetation makes up over 90 percent of their diet, young birds feed almost exclusively in insects (Schroeder 1984).

Blue grouse occur across the Malheur National Forest. Winter roost habitat occurs on approximately 6,800 acres. Invasive plants do not pose a direct threat to this species. Invasive plants have been mapped on approximately 1,870 acres of suitable coniferous forest habitat. One acre of invasive plants has been mapped within winter roost habitat. Invasive plants are not considered a direct threat to blue grouse.

Bighorn Sheep

Bighorn sheep generally inhabit open areas of rocky slopes, ridges, rim rocks, cliffs, and canyon walls with adjacent grasslands or meadows, and few trees (Verts and Carraway 1998). Dense forest communities are avoided. Their primary diet consists of bunchgrass, but also includes significant amounts of forbs and shrubs during the growing seasons. In the spring they will also utilize cheatgrass, which is an invasive annual plant. Most bighorn sheep use forage areas within one-half mile but up to 1 mile of escape terrain of escape terrain. Summer and winter range must provide freedom from disturbance and a proper juxtaposition of forage, escape terrain, and water.

California bighorn sheep were introduced into the Strawberry Mountain Wilderness and near Aldrich Mountain. Excellent summer range and adequate quality winter range have contributed to an expanding or stable population. The Aldrich Mountain herd unit totals 69,060 acres and contains 13 acres of known invasive plants, whereas less than an acre is known to occur in the 58,688 acres Strawberry Mountain unit. Based on known infestations, invasive plants are not currently impacting bighorn sheep or their habitat.

Osprey

Osprey are highly migratory raptors that typically breed and nest along larger rivers, lakes and reservoirs. Osprey feed almost exclusively on fish and documented nests in Oregon are almost always located close to water with adequate fish populations. Osprey have been documented on the Forest and suitable nesting and foraging habitat exists along rivers and lakes. currently 67 acres of invasive plants are mapped within 300 feet. of waterbodies or rivers that may be used for nesting or foraging. Invasive plants are not a direct threat to osprey.

Pronghorn Antelope

In Oregon habitat includes sagebrush steppe, as well as areas occupied by widely spaced juniper or ponderosa pine. For most of the year water is essential and animals are seldom found far from available sources, with most herds within 2.5 and 5 miles of water. In spring and summer, broad leaved herbaceous vegetation is the preferred food, although pronghorn will browse on tips of sagebrush in winter and

occasionally eat some grasses. Common food plants include longleaf phlox, wallflower and balsamroot. Pronghorn are fairly common in the open valley areas on the Forest and adjoining private, state and federal lands. Populations appear to be increasing slightly.

Approximately 78,000 acres of pronghorn habitat occur adjacent to larger blocks of habitat on private lands. Approximately 122 acres of invasive plants are mapped within this habitat. Invasive grasses can reduce habitat for local populations of antelope (California Department of Fish and Game 2013).

Landbirds

Landbirds evaluated in this analysis include focal species associated with priority or unique habitats identified in the Partner in Flight (PIF) Conservation Strategy for Landbirds of the Northern Rocky Mountains of Eastern Oregon and Washington (Altman 2000), those identified in the PIF Conservation Strategy for the Columbia Plateau of Eastern Oregon and Washington (Altman and Holmes 2000). These focal species and their habitat are displayed in the following tables

Table 54. Northern Rocky Mountain Habitat Types - Landbird Focal Species and Their Habitats

Habitat	Habitat Feature	Focal Species
Priority Habitats		
Dry Forests	Large patches of old forest with large trees/snags	White-headed Woodpecker[1]
	Old Forest with grassy openings an dense thickets	Flammulated Owl
	Open understory with regenerating pines	Chipping Sparrow
	Patches of burned old forest	Lewis' Woodpecker[1]
Mesic Mixed Conifer (Late Successional	Large Snags	Vaux's Swift
	Overstory canopy closure	Townsend's Warbler
	Structurally diverse, multi-layered	Varied Thrush
	Dense shrub layer in forest openings or understory	MacGillivray's Warbler
	Edges and openings created by wildfire	Olive-sided Flycatcher
Riparian Woodland	Large Snags	Lewis' Woodpecker[1]
	Canopy foliage and structure	Red-eyed Vireo
	Understory foliage and structure	Veery
Riparian Shrub	Willow/alder shrub patches	Willow Flycatcher
Unique Habitats		
Sub-alpine Meadows		Hermit Thrush
Montane Meadows (wet/dry)		Upland Sandpiper[1]
Steppe Shrublands		Vesper Sparrow
Aspen		Red-naped Sapsucker
Alpine		Gray-crowned Rosy Finch

1 – Also evaluated as an MIS or featured species

Table 55. Columbia Plateau Habitat Types - Landbird Focal Species and Their Habitats

Habitat	Habitat Feature	Focal Species
Priority Habitats		
Steppe-Grassland	Native bunchgrass cover	Grasshopper Sparrow1
Steppe-Shrubland	Interspersion of tall shrubs and openings	Loggerhead Shrike
	Burrows	Burrowing Owl
	Deciduous trees and shrubs	Sharp-tailed Grouse
Sagebrush	Large areas with diverse understory	Sage Grouse[1]
	Large contiguous patches	Sage Sparrow
	Sagebrush cover	Brewer' Sparrow
	Sagebrush height	Sage Thrasher
Shrublands	Ecotonal edges of herb, shrub and tree habitat	Lark Sparrow
	Upland sparsely vegetated desert shrub	Black-throated Sparrow (BR and OW only)
Juniper-Sage Steppe	Scattered mature juniper trees (savannah)	Ferruginous Hawk
Riparian Woodland	Large snags (cottonwood)	Lewis' Woodpecker[1]
	Large canopy trees	Bullock's Oriole
	Subcanopy foliage	Yellow Warbler
	Dense shrub layer	Yellow-breasted Chat
	Large structurally diverse patches	Yellow-billed Cuckoo[1]
Riparian Shrub	Dense shrub patches	Willow Flycatcher
	Shrub-herbaceous interspersion	Lazuli Bunting
Unique Habitats		
Aspen	Large trees and snags with regeneration	Red-naped Sapsucker
Agricultural Fields	Mesic Conditions	Bobolink
Cliffs and Rimrock	Undeveloped foraging areas	Prairie Falcon
Juniper Woodland	Mature trees with regeneration	Gray Flycatcher
Mountain Mahogany	Large diameter trees with regeneration.	Virginia' Warbler

1 – Also evaluated as an MIS, sensitive or featured species

Nationwide Birds of Conservation Concern

In an effort to conserve bird species of concern and comply with the Migratory Bird Treaty Act, the United States Fish and Wildlife Service developed a Nationwide Birds of Conservation Concern (BCC) list in 2002. This BBC list was updated in 2008 (USFWS-2008) and identifies species, sub-species, and populations of migratory and non-migratory birds in need of additional conservation action. These species are deemed to be the highest priority for conservation actions and would be considered prior to taking management actions. Bird Conservation Regions (BCRs) were developed based on similar geographic parameters and each BCR identifies species of concern. The project area includes BCR 10, (Northern Rockies) and table 56 lists bird species of concern within this region.

Table 56.Birds of Conservation Concern

Bird Species	Preferred Habitat
Bald Eagle[1]	Forest with Large Trees Near Open Water
Swainson's Hawk	Elevated Nest Sites In Open Country
Ferruginous Hawk	Elevated Nest Sites In Open Country
Peregrine Falcons[1]	Cliffs, Wide Range Of Habitats
Upland Sandpipers[1]	Grasslands
Long-Billed Curlew	Grasslands
Yellow-Billed Cuckoos	Dense Riparian Cottonwoods
Flammulated Owl	Open Ponderosa Pine Forests
Black Swift	Cliffs Associated With Waterfalls For Nesting, Forage In Forest and Open Areas
Calliope Hummingbird	Open Forest And Shrubs At Higher Elevations And Riparian Areas.
Lewis's Woodpeckers[1]	Mature Open Forest With Large Snags
Williamson's Sapsucker[1]	Coniferous Forest and Aspen With Snags
White-Headed Woodpeckers[1]	Old Open Forest With Large Snags.
Olive-Sided Flycatcher	Edges And Openings Within Forest
Willow Flycatcher	Dense Shrub Patches
Loggerhead Shrike	Grasslands, Open Woodlands, Juniper/Sage
Sage Thrasher	Large Patches Of Sagebrush
Brewer's Sparrow	Dense Sagebrush
Sage Sparrow	Large Patches Of Sagebrush
McCown's Longspur	Sparse Grasslands
Black Rosy-Finch	Above Timberline In Bare Rock, Cirques, Cliffs
Cassin's Finch	Open Mature Coniferous Forest

1 – Also evaluated as an MIS, sensitive or featured species

Gamebirds below Desired Condition

This list includes species whose populations are below long-term averages or management goals, or for which there is evidence of declining population trends (USDI Fish and Wildlife Service 2013c). Table 51 displays GBBDC species that may occur within the project area (Cornell Lab of Ornithology 2013), feeding strategies and preferred habitat.

Table 57. Gamebirds below desired condition

Species	Habitat
Canvasback	Wetlands, ponds and lakes (plants and aquatic insects)
Mourning Dove	Open forest and woodlands (seeds)
Ring-necked Duck	Marshes and ponds, open water wetlands. (plants and aquatic invertebrates)
Wood Duck	Swamps, ponds and wetlands with snags (insects, seeds and fruit, acorns)
Mallard	Wetlands, ponds and lakes, roadside ditches (aquatic plants and insects)
Northern Pintail	Open country with shallow wetlands (insects and seeds)
Redhead	Lakes and ponds (plants)
Lesser Scaup	Lakes and ponds feeds on insects (aquatic insects and plants)
American Wigeon	Wetlands, ponds, marshes and rivers (aquatic insects and plants)

3.7.3 Environmental Consequences

This section evaluates effects to wildlife and wildlife habitat discussed in section 3.62 and includes an analysis for each of the alternatives considered as well as an evaluation of effects to threatened and endangered and regionally sensitive species, management indicator species, featured species and birds of conservation concern.

Analysis Methodology

The Forest Service contracts with Syracuse Environmental Research Associates, Inc. (SERA) to conduct ecological risk assessments for herbicides proposed for use on National Forest System lands. The information contained in this document relies on these risk assessments and interpretations from the R6 2005 FEIS.

To determine potential effects, representative species groups of wildlife and data from existing laboratory and field studies were used to discover which groups of species might be at the greatest risk from herbicide use. The general categories analyzed, and exposure scenarios developed, depended upon available toxicity data and species of concern in Oregon.

An exposure scenario was developed, when enough data was available, and a quantitative estimate of dose received by the animal type in the scenario was calculated (SERA, 2007). The scenarios used to calculate doses include direct spray of small mammals, birds and mammals eating vegetation or insects sprayed with herbicide, predatory mammals and birds eating small mammals or fish, and small mammals drinking contaminated water. The risk assessments prepared by SERA (2001a, b; 2003a-d; 2004a-f; 2007; 2011a-d) contain detailed analysis of the potential effects of each herbicide. Portions of risk assessments pertaining to wildlife are summarized in Appendix P of the R6 2005 FEIS.

The quantitative estimates of dose were compared to available toxicity data to determine potential adverse impacts. For this analysis, the most sensitive response (i.e., a sub-lethal effect that occurred at the lowest dose) from the most sensitive species was used to determine “toxicity indices” for each herbicide. When a calculated dose was greater than the toxicity index, the analysis stated that there was a potential for adverse effects. This approach assumes maximum potential effects of herbicides even though the pdfs and herbicide-use buffers would minimize potential exposure.

The toxicity index acts as a threshold; doses below the index would result in no known (or discountable) effect and doses substantially above a threshold would be considered to possibly pose some risk. The level of risk depends on how far above the threshold a particular dose is estimated to be. Due to the nature of the toxicity data, doses only slightly above the toxicity index would still be considered to pose no likely risk (Hazard Quotients of 2-10).

In order to analyze potential effects from proposed invasive plant treatments on the project area, each species of conservation concern was assigned to an exposure scenario category (e.g. small insectivorous bird, large herbivorous mammal, etc.). Results of risk assessments for each herbicide and NPE surfactants were then applied to each species within the exposure scenario category to evaluate risk of each herbicide or surfactant.

Professional judgment was used to evaluate the life history traits (e.g., diet, habitat, activity patterns, seasonal occurrence, etc.) of each wildlife species evaluated to determine the likelihood of exposure to herbicides or surfactant used to treat invasive plants. The combinations of likelihood of exposure, dose estimated from exposure scenarios, and GIS wildlife location data for the Malheur National Forest was used to determine the risk of effect from herbicide treatments.

Data Limitations

The data for amphibians is much more limited than that available for mammals and birds and for most herbicides, available data is not sufficient to conduct quantitative estimates of exposure and toxicity data for amphibians. The Forest Service/SERA Risk Assessments use information from the literature, when available, and the calculated concentrations of herbicide in water from runoff or accidental spill to determine risk to amphibians. When data on amphibians were not available, fish were used as surrogate species. Data suggest that amphibians may be as sensitive to herbicides as fish (Berrill et al. 1994; Berrill et al. 1997; Perkins et al. 2000). For the purposes of this analysis, herbicides that pose potential risk to fish (as determined by the quantitative estimates from exposure scenarios) were also considered to pose a risk to amphibians.

Data is limited regarding the potential effects of herbicides on mollusks. Only glyphosate and picloram have been tested on a terrestrial mollusk; the brown garden snail (*Helix aspersa*). Neither glyphosate nor picloram appeared to pose a risk to the snail (USDA Forest Service 2005e). Relyea (2005b) found no effect to three species of aquatic snails from the glyphosate formulation Roundup®.

Insufficient data is available in many cases to allow for a quantitative risk assessment. For instance, there is no quantitative scenario for a predatory bird that eats primarily other birds, such as the peregrine falcon, so the “fish-eating bird” scenario was used as a surrogate. This scenario likely overestimates the dose to the peregrine falcon because the hypothetical fish consumed are from a pond contaminated by a large spill of herbicide. These hypothetical fish likely have higher concentrations of herbicide in their bodies (and thus a higher dose to the predatory bird) than would a small bird that incidentally ingested herbicide before it was preyed upon. Data was insufficient to assess risk of chronic exposures for a large grass-eating bird from NPE exposure, or insect-eating birds and mammals for several herbicides.

Direct spray of small mammals and consumption of small mammals that have been directly sprayed by predatory birds or mammals exceed the toxicity indices for a few herbicides. However, these scenarios, while possible, were determined to not be plausible. Small mammals are generally nocturnal and spend daylight hours either in burrows or in trees and would be very unlikely to be directly sprayed. In the case of predatory birds or mammals, the predator would have to consume an entire day’s diet worth of directly sprayed small mammals to receive the dose that exceeded the toxicity index.

Research has not been conducted on the effect of proposed herbicides to most free-ranging wildlife, so the relevant data to specifically evaluate effects to different wildlife species is incomplete or unavailable. Specific relevant data that is lacking includes:

- For several herbicide/species group combinations, both NOAEL and LOAEL values have not been determined.
- There is insufficient data to assess risk of chronic exposures for a large grass-eating bird or small insect-eating birds and mammals.
- The toxicity of the herbicides to amphibians, reptiles, terrestrial invertebrates, birds and other animals found in Region 6 is either unknown or limited, and cannot be fully characterized with the available data on surrogate species.
- Analysis of effects for any project involving herbicide use relies on extrapolations from laboratory animals to free-ranging wildlife and controlled conditions to the natural environment.
- There is less data available for birds than mammals, so mammal toxicity values must be used in bird exposure scenarios for some of the herbicides considered.

Limitations notwithstanding, a substantial amount of scientific data on the toxicity of proposed herbicides to birds and mammals, and some amphibians and invertebrates exist. The data is generated by

manufactures to meet EPA regulations before an herbicide may be registered for use, and by independent researchers that have published findings in peer-reviewed literature. So while some data is lacking, adequate information exists to assess potential impacts of the herbicides proposed on wildlife.

Effects of Alternative A (No Action)

Under alternative A, no proposed project activities would occur, and therefore no direct or indirect treatment-related effects would occur. While current levels of invasive plant control may continue on lands of other ownership, invasive plants would continue to establish and spread within the project area at the rate of approximately 8 to 12 percent per year (R6 2005 FEIS) (consistently applied prevention measures since 2005 assume this rate to be reduced by half (R6 2005 ROD)). Native plants and habitats would continue to be threatened by invasive plants. Effects on wildlife would vary. For closed-canopy forest species (e.g. goshawk) or species that are not affected by invasive plants (e.g. woodpeckers or bats), or species that occupy habitat away from invasive plant vectors (e.g. Wallowa rosy finch), there would be little effect to existing or future habitat.

Due to their proximity to invasive plant vectors and more open canopy conditions, habitats such as grassland/meadows, sagebrush, open-canopied forest (e.g. savannah) and many wetland/riparian areas would continue to be affected by invasive plants. Effects to wildlife dependent on these communities would be a reduction in cover or forage as native habitat is replaced by non-natives. Infestations that become so well established that future treatment is cost-prohibitive could result in permanent loss of habitat (Asher 2002). For example, habitat loss via invasive plant infestation has been reported to occur in Oregon spotted frog habitat that is invaded by reed canarygrass (Hayes 1997). Sage grouse and pygmy rabbits could be displaced if invasive plants expand into native rangeland (Connelly et al. 2000, Weiss and Verts 1984) and foraging habitat for elk and other big game could decrease (Rice et al. 1997). The spread of invasive wetland plants can also reduce waterfowl nesting habitat (Blossey 1999).

Consequently under alternative A, the long-term loss of native vegetation and habitat due to continued encroachment of invasive plants would adversely affect species such as elk, antelope, grasshopper sparrow, greater sage grouse, upland sandpiper, bobolink, Columbia spotted frog, silver-bordered fritillary and several migratory birds of concern is increased.

Effects Common to all Action Alternatives

This section discusses general effects on wildlife that are common to all action alternatives and is based on effects of invasive plant treatments to wildlife that are evaluated in detail in the R6 2005 FEIS, the corresponding Biological Assessment (USDA Forest Service 2005c), project files, and SERA risk assessments.

General Effects of Treatment

All treatment methods have the potential to disturb, temporarily displace, or directly harm various wildlife species. Conversely, successful control of invasive plant infestations provides long-term benefits to wildlife, by restoring native habitats. Potential adverse effects to wildlife are determined largely by the potential for exposure to treatment. Because most invasive species are shade intolerant, the majority of treatments occur in openings, early structural habitat, or in forested habitat with a relatively open canopy. Consequently species that occur primarily in closed-canopy forests are less likely to be affected by proposed treatments. Conversely, species that prefer or require relatively open habitats are more likely to be adversely affected by both plant infestation and treatment.

The effects of the invasive plant treatments on wildlife are relative to the size and locations of existing and future invasive plant infestations, the type of treatment used, and the timing and duration of the treatments. Treatment of infestations along disturbed roadsides are not likely to substantially affect terrestrial wildlife populations, since this vegetation type does not provide essential habitat for native

wildlife species, and it consists of long, narrow areas spread over large distances. Treatment of large infested areas may create more disturbances for longer periods than treatment of small infestations. Treatment of dense infestations can create bare ground, which may reduce cover and expose certain species to increased predation. However, dense infestations of invasive plants do not typically occur in areas of the Malheur National Forest that provide suitable habitat for most wildlife species.

For the most part, invasive plant treatments would not alter habitat structure or composition for terrestrial wildlife species. Most of the invasive plants on the Malheur National Forests are forbs, thus woody species, and shrubs and trees would not likely be affected by treatments. Impacts to non-target forbs and grasses would generally be minor and occur within treated areas or within short distances of treated areas (less than 100 feet, 15 feet for spot treatment). In some cases, removal of invasive plants could cause a localized decrease in the amount of vegetative cover provided. However due to the patchy nature of invasive plant infestations, there would be little cover lost. Unlike other management activities (i.e. timber harvest), invasive plant treatments are not likely to reduce available habitat or prey availability.

Manual and Mechanical Treatments

Disturbance from manual and mechanical treatments is likely to pose greater risks to terrestrial wildlife species than herbicide or cultural methods (USDA Forest Service 2005e). Small species that lack rapid mobility (e.g. amphibians, mollusks) and ground nesting birds are vulnerable to crushing or injury from people or equipment. Manual treatments can take longer to implement than other methods, increasing the length of time of disturbance. Manual treatments are often used at small sites, where the potential to impact wildlife would be minimal, but may also be used in large areas with scattered invasive plants. In these situations, crews of 3-5 people may be in an area for more than a day. Bare ground is likely to be patchy in distribution with this method and less likely to interfere with animal movement or dispersal. Mechanical methods can generate more noise disturbance than other methods. Hand held mechanical equipment like chainsaws and trimmers can be used very selectively on target plants and may be less likely than larger equipment to harm wildlife. Use of vehicle mounted equipment, like mowers, is less selective and more likely to directly impact small animals than use of hand operated equipment, such as string trimmers.

Biological Control

Biological control is proposed on sites that are either too large to be sprayed with herbicides, where invasive plant species are so abundant that other methods would not be practical, or where the biological control agent is effective on the target plant species and treatment can reduce or eliminate the need for herbicides.

Biological control will not directly affect native wildlife species; however, recent studies have found that native rodents may take advantage of the food source provided by biological control agents (Pearson et al. 2000). Effects include short-term disturbance similar to that described under manual treatment during release. Although some bio control agents available have adverse effects to non-target wildlife, only APHIS and State-approved biological control agents would be used. Also agents demonstrated to have direct negative impacts on non-target organisms would not be released. As a result there are no adverse effects to wildlife anticipated under any alternative.

Due to the maintenance of native vegetation and habitat, indirect effects of biological control include reducing invasive plant populations and providing a supplemental food source, both of which can have long-term benefits to wildlife.

Cultural/Restoration

Restoration or reclamation of sites infested with invasive plants follow treatment restoration standard 13 (USDA Forest Service 2005b) and incorporate guidelines for re-vegetation of invasive weed sites and

other disturbed areas on National Forests and Grasslands in the Pacific Northwest (Erickson et al. 2003). On degraded sites where reproducing individuals of desirable species are absent or in low abundance, re-vegetation with well adapted and native competitive grasses, forbs and legumes can be used to direct and accelerate plant community recovery, reduce erosion, and restore native wildlife habitat conditions. Restoration treatments proposed under the action alternatives include mulching, seeding and planting, and grazing. Effects of mulching, seeding and planting on wildlife are similar to those described under manual treatments and include short-term avoidance of the site during treatment. Due to the small amount of treatment proposed, scattered nature of proposed sites, widespread availability of unaffected habitat, and with implementation of pdfs to protect species of conservation concern, effects to wildlife would be limited to short-term disturbance of the site during treatment.

Herbicide Effects to Wildlife

Results of numerous field studies indicate the likelihood for direct adverse effects to wildlife from herbicide use is low (Marshall and Vandruff 2002, Dabbert et al. 1997, Fagerstone et al. 1977, Rice et al. 1997, Sullivan et al. 1998, Cole et al. 1997, Cole et al. 1998, Johnson and Hansen 1969, Nolte and Fulbright 1997, McMurry et al. 1993a, and McMurry et al. 1993b), however, use of herbicides to treat invasive plants does have the potential to harm free-ranging wildlife (USDA Forest Service 2005b p. 1-11). Herbicides can also cause some malformation or mortality to amphibians that have been exposed to herbicides or surfactants in water (Relyea 2005).

Risk from herbicide exposure was determined using data and methods outlined in the SERA risk assessments. A quantitative estimate of dose was compared to toxicity indices (table 58 and table 59). If a dose exceeded the toxicity index, then it was determined to have potential for an adverse effect. Quantitative estimates of dose for each animal group for each herbicide are contained in the project file worksheets. Wildlife species evaluated were placed into groups based on taxa type (e.g. bird, mammal), body size, and diet (e.g. insect-eater, fish-eater, plant-eater). Exposure scenarios for the various groupings were used to quantitatively estimate dose and characterize risk at both the typical and highest application rate for each herbicide/surfactant. Exposure scenario results were evaluated in terms of whether or not they exceeded the NOAEL (No Observed-Adverse Effect Level) for an acute exposure (i.e. consumed exclusively contaminated prey during a 24 hour period) or chronic exposure (i.e. consumed nothing but contaminated prey for 90 days). Table 58 and table 59display the toxicity indices for birds and mammals used in this analysis, whereas table 60 displays exposure scenarios considered. Toxicity indices represent the most sensitive endpoint from the most sensitive species for which adequate data are available. Toxicity results are discussed in more detail in Appendix P of the R6 2005 FEIS.

Table 58. Toxicity indices for birds

Herbicide	Duration	Endpoint	Dose	Species	Effects Noted at LOAEL
Aminopyralid	Acute	NOAEL	14 mg/kg	Quail	Ruffled appearance at 23 mg/kg
	Chronic	NOEC	184 mg/kg/day*	Mallard	No adverse effects to adults or offspring at highest dose tested (184 mg/kg/day)
Chlorsulfuron	Acute	NOAEL	1686 mg/kg	Quail	No significant effects at highest dose
	Chronic	NOAEL	140 mg/kg/day	Quail	No significant effects at highest dose
Clopyralid	Acute	NOAEL	670 mg/kg	Mallard & Quail	No signs of toxicity reported, LOAEL not determined
	Chronic[1]	NOAEL	15 mg/kg/day	Rat	Thickening of gastric epithelium at 150 mg/kg/day
Glyphosate	Acute	NOAEL	562 mg/kg	Mallard & Quail	No effects at highest dose
	Chronic	NOAEL	100 mg/kg	Mallard &	No effects on reproduction at highest

Herbicide	Duration	Endpoint	Dose	Species	Effects Noted at LOAEL
				Quail	dose
Imazapic	Acute	NOAEL	1100 mg/kg	Quail	No effects at highest dose
	Chronic	NOAEL	113 mg/kg/day	Quail	Decreased weight gain in chicks at 170 mg/kg/day
Imazapyr	Acute	NOAEL	674 mg/kg	Quail	No effects at highest dose
	Chronic	NOAEL	200 mg/kg/day	Mallard & Quail	No effects at highest dose
Metsulfuron methyl	Acute	NOAEL	1043 mg/kg	Quail	No significant effects at highest dose
	Chronic	NOAEL	120 mg/kg/day	Mallard & Quail	No significant effects at highest dose
Picloram	Acute	NOAEL	1500 mg/kg	Chicken & pheasant	No effect to reproduction. LOAEL not reported
	Chronic[1]	NOAEL	7 mg/kg/day	Dog	Increased liver weight at 35 mg/kg/day
Sethoxydim	Acute	NOAEL	>500 mg/kg	Mallard & Quail	No or low mortality at highest doses tested. LOAEL not available.
	Chronic	LOAEL[2]	10 mg/kg/day	Mallard	Decreased number of normal hatchlings at 10 mg/kg/day
Sulfometuron methyl	Acute	NOAEL	312 mg/kg	Mallard	Decreased weight gain at 625 mg/kg/day
	Chronic[1]	NOAEL	2 mg/kg/day	Rat	Effects on blood and bile ducts at 20 mg/kg/day
Triclopyr BEE	Acute	LD_{50}	388 mg/kg	Quail	50% mortality at 388 mg/kg
	Chronic	NOAEL	10 mg/kg/day	Mallard & Quail	Decreased survival of offspring, reduced eggshell thickness at 20 mg/kg/day
Triclopyr TEA	Acute	LD_{50}	535 mg/kg	Quail	50% mortality at 535 mg/kg
	Chronic	NOAEL	10 mg/kg/day	Mallard & Quail	Decreased survival of offspring, reduced eggshell thickness at 20 mg/kg/day.
NPE Surfactants[3]	Acute	NOAEL	10 mg/kg	Rat	Slight reduction of polysaccharides in liver at 50 mg/kg/day
	Chronic	NOAEL	10 mg/kg/day	Rat	Increased weights of liver, kidneys, ovaries, and decreased live pups at 50 mg/kg/day

* The chronic toxicity index is higher than the acute toxicity index because the acute value is based on a gavage study and the chronic value is based on a dietary exposure study. There are substantial differences in effects from the different dose methods. Effects from gavage dosing were rapidly reversed, but are used in the assessment of risk to be conservative. This may lead to a gross overestimate of acute risk (SERA 2007, p. 96-97).

1 Chronic toxicity studies in birds are not available, so the value from mammal studies is used.

2 Based on one study in which a NOAEL was not determined, so the LOAEL is used.

3 Data on birds is not available in published literature so data from mammals is used.

Sources: SERA 1998, 2001, 2003, 2004, 2007; 2011, Bakke 2003;

Table 59. Toxicity indices for mammals

Herbicide	Duration	Endpoint	Dose	Species	Effect Noted at LOAEL
Aminopyralid	Acute	NOAEL	104 mg/kg	Rabbit	Weight loss and in coordination at 260 mg/kg
	Chronic	NOAEL	50 mg/kg/day	Rat	Cecal enlargement at 500 mg/kg/day
Chlorsulfuron	Acute	NOAEL	75 mg/kg	Rabbit	Decreased weight gain at 200 mg/kg
	Chronic	NOAEL	5 mg/kg/day	Rat	Weight changes at 25 mg/kg/day

Herbicide	Duration	Endpoint	Dose	Species	Effect Noted at LOAEL
Clopyralid	Acute	NOAEL	75 mg/kg	Rat	Decreased weight gain at 250 mg/kg
	Chronic	NOAEL	15 mg/kg/day	Rat	Thickening of gastric epithelium at 150 mg/kg/day
Glyphosate	Acute	NOAEL	175 mg/kg	Rabbit	Diarrhea at 350 mg/kg
	Chronic	NOAEL	175 mg/kg/day	Rabbit	Diarrhea at 350 mg/kg
Imazapic	Acute	NOAEL	350 mg/kg	Rabbit	Decreased body weight at 500 mg/kg
	Chronic	NOAEL[2]	45 mg/kg	Dog	Microscopic muscle effects at 137 mg/kg
Imazapyr	Acute	NOAEL	250 mg/kg	Dog	No effects at highest doses tested
	Chronic	NOAEL	250 mg/kg/day	Dog	No effects at highest doses tested
Metsulfuron methyl	Acute	NOAEL[3]	25 mg/kg	Rat	Decreased weight gain at 500 mg/kg
	Chronic	NOAEL	25 mg/kg/day	Rat	Decreased weight gain at 125 mg/kg
Picloram	Acute	NOAEL	34 mg/kg	Rabbit	Decreased weight gain at 172 mg/kg
	Chronic	NOAEL	7 mg/kg	Dog	Increased liver weight at 35 mg/kg[4]
Sethoxydim	Acute	NOAEL	160 mg/kg[5]	Rabbit	Reduced number of viable fetuses, some dam mortality at 480 mg/kg
	Chronic	NOAEL	9 mg/kg/day	Dog	Mild anemia at 18 mg/kg/day
Sulfometuron methyl	Acute	NOAEL	87 mg/kg	Rat	Decreased body weight at 433 mg/kg
	Chronic	NOAEL	2 mg/kg/day	Rat	Effects on blood and bile ducts at 20 mg/kg/day
Triclopyr	Acute	NOAEL	100 mg/kb	Rat	Malformed fetuses at 300 mg/kg
	Chronic	NOAEL	0.5 mg/kg/day	Dog	Effect on kidney at 2.5 mg/kg/day
NPE Surfactants	Acute	NOAEL	10 mg/kg	Rat	Slight reduction of polysaccharides in liver at 50 mg/kg/day
	Chronic	NOAEL	10 mg/kg/day	Rat	Increased weights of liver, kidneys, ovaries, and decreased live pups at 50 mg/kg/day

2 Imazapic – NOAEL calculated from a LOAEL of 137 mg/kg/day and application of a safety factor of 3 to extrapolate from a LOAEL to a NOAEL.

3 The acute NOAEL of 24 mg/kg is very close to the chronic NOAEL, so chronic value is used for acute exposures.

4 US EPA/OPP 1998

5 Source of the value used by EPA (180 mg/kg) is not well documented, so the lower value of 160 mg/kg from a rabbit study is used as the toxicity index for this analysis.

Source: SERA 1998, 2001, 2003, 2004, 2007, 2011 and Bakke, 2003.

Symbol meanings for the following table are as follows:

-- Exposure scenario results in a dose below or equivalent to the toxicity index.
× Exposure scenario results in a dose that exceeds the toxicity index at typical and highest application rates.
¨ Exposure scenario results in a dose that exceeds the toxicity index at highest application rates only.

Table 60. Exposure scenario results from FS risk assessments for mammals, birds, and honeybees, using the typical and highest application rates and assuming upper residue rates

Animal/Scenario	Aminopyralid	Chlorsulfuron	Clopyralid	Glyphosate	Imazapic	Imazapyr	Metsulfuron methyl	Picloram	Sethoxydim	Sulfometuron methyl	Triclopyr	NPE Surfactant
Acute Exposures												
Direct spray, bee	--	--	--	¨	--	--	--	--	--	--	--	--
Direct spray, sm. mammal	--	--	--	--	--	--	--	--	--	--	--	×
Consume contaminated vegetation												
small mammal	--	--	--	--	--	--	--	--	--	--	--	¨
large mammal	--	--	--	¨	--	--	--	¨	--	--	--	×
large bird	--	--	--	--	--	--	--	--	--	--	×	×
Consume contaminated water												
Spill, sm. mammal	--	--	--	--	--	--	--	--	--	--	--	--
Consume contaminated insects												
small mammal	--	--	--	¨	--	--	--	¨	--	--	--	×
small bird	--	--	--	¨	--	--	--	--	--	--	×	×
Consume contaminated prey												
carnivore (sm. mammal)	--	--	--	--	--	--	--	--	--	--	--	--
predatory bird (sm. mammal)	--	--	--	--	--	--	--	--	--	--	--	¨
predatory bird (fish)	--	--	--	--	--	--	--	--	--	--	--	--
Chronic Exposures												
Consume contaminated vegetation												
small mammal, on site	--	--	--	--	--	--	--	--	--	--	--	--
lg. mammal, on site	--	--	--	--	--	--	--	--	--	¨	×	--
lg. bird, on site	--	--	--	¨	--	--	--	--	¨	¨	×	--
Consume contaminated water												
small mammal	--	--	--	--	--	--	--	--	--	--	--	--
Consume contaminated insects#												
small mammal	--	--	unk	unk*	--	--	--	unk	unk	unk	unk	unk
small bird	--	--	unk	unk	--	--	--	unk	unk	unk	unk	unk
Consume contaminated prey												
carnivore (sm. mammal)#	--	--	--	--	--	--	--	--	--	--	×	¨
predatory bird (sm. mammal)#	--	--	--	--	--	--	--	--	+	--	--	¨
predatory bird (fish)	--	--	--	--	--	--	--	--	--	--	--	--

Data are lacking regarding chronic exposures, so effects are assumed by comparing acute dose vs. chronic NOAEL, which will likely over-estimate actual risk.

unk – unknown; insufficient data to assess risk.

*unknown only at highest rates; typical rates pose no apparent risk.

+ Previous versions of this table showed an exceedence at high application rate for a chronic scenario. That is not shown here, because the actual estimated dose is equivalent to the toxicity index, rather than an exceedence.

While the amount of each herbicide/surfactant applied varies, many of the pdfs were specifically designed to ensure that any application rates used were below levels that would result in an exposure of a non-target species that exceeded the NOAEL.

Standards in the Malheur National Forest LRMP require that adverse effects to wildlife from invasive plant treatment be minimized or eliminated through project design and implementation. All action alternatives were designed to comply with these standards. Project design features (pdfs) and herbicide-use buffers place restrictions on how and where herbicides are applied.

Results of the herbicide analysis indicate that birds and mammals consuming vegetation or insects that have been sprayed with some of the herbicides have the most potential to receive doses above the toxicity index, although other scenarios occasionally exceeded the toxicity index. While all proposed herbicides are considered low risk, in order to compare toxicity risks, proposed herbicides/surfactants were placed into the following four categories of "relative risk". Adherence to invasive plant treatment standards and pdfs; actual animal behavior and feeding strategies, and/or seasonal presence/absence within treatment area reduce these risks. As a result and considering the limited spatial extent of infestation (over 80 percent of sites are 0.25 acres or less), wildlife is not likely to be exposed to harmful levels of herbicides under the action alternatives.

- **Herbicides that Do Not Pose a Risk** – These include herbicides that don't pose a risk to wildlife at either typical or highest application rates and include aminopyralid, chlorsulfuron, imazapic, imazapyr and metsulfuron methyl. There are no exposure scenarios anticipated that would result in adverse effects to wildlife from application of these herbicides.
- **Lower Risk Herbicides** – These herbicides which include clopyralid, sethoxydim and sulfometuron methyl, did not pose a risk to wildlife at typical application rates, although sethoxydim and sulfometuron methyl posed a chronic risk to some species at the highest application rate. While data is lacking to fully assess chronic impacts to an insectivorous small mammal or bird, with implementation of pdf F2, these herbicides would not be applied above the typical application rate.
- **Moderate Risk Herbicides** – These herbicides, which include picloram and glyphosate do not pose a risk at typical application rates, but do pose an acute and chronic risk for some groups at the highest application rate. Also picloram is more persistent in some soil types. While data is lacking to fully assess chronic impacts to an insectivorous small mammal or bird, with implementation of pdf 2, these herbicides would not be applied above the typical application rate.
- **Higher Risk Herbicides**– Of the herbicides/surfactants proposed only triclopyr and NPE-based surfactants fall into this category because they exceeded the toxicity index for several species groups at both the typical and highest application rate. While data is lacking to fully assess chronic impacts to an insectivorous small mammal or bird, with implementation of the Malheur National Forest LRMP standard that limits use of triclopyr to selective techniques only, and pdf F2 that requires that NPE-based surfactants only be broadcast at 0.5 lbs. active ingredient per acre, it is unlikely that these herbicides would pose a risk to wildlife.

As described above, effects to wildlife vary depending on the type of herbicide application proposed or the use of non-herbicide treatments. Also the effectiveness of the action alternatives at controlling or containing invasive plants varies by treatment. Table 61 displays the first year/first choice treatments that would occur in each action alternative and identifies alternative treatments within wildlife habitats that are considered to be "at risk" from invasive plants. The information presented is used in the alternative analysis to compare the extent and type of treatment within habitats affected and to help assess the effectiveness of each of the alternatives at controlling invasive plants.

Table 61. First year/first choice treatments by habitat type and action alternative

Habitat	Invasive Plant Acres	Alternative B Acres			Alternative C Acres			Alternative D Acres		
		Herbicide		No Herbicide	Herbicide		No Herbicide	Herbicide		No Herbicide
		Bcast	Spot		Bcast	Spot		Bcast	Spot	
Dry Forest[4]	1,386	845	541	0	0	532	854	390	996	0
Mesic Mixed Conifer	355	219	136	0	0	109	246	87	268	0
Riparian Woodland[1,3]	678	367	312	0	0	34	644	19	660	0
Riparian Shrub[1,3]	64	29	35	0	0	2	62	1	63	0
Montane Meadow	47	30	18	0	0	16	31	14	34	0
Steppe Shrubland[2,3]	72	43	29	0	0	27	45	19	53	0
Sagebrush[3]	79	14	65	0	0	22	57	14	65	0
Juniper Woodland	28	14	14	0	0	8	20	5	23	0
Grassland[3]	122	73	49	0	0	25	97	20	102	0
Wetland[3]	69	38	31	0	0	5	64	3	66	0

1 – Some of the riparian habitats are also included as other forest or non-forest communities
2 – Some inclusions of sagebrush are included in steppe shrublands
3 – Habitats that are considered to be most “at risk” from invasive plants
4 – Understory vegetation within open canopy dry forest can be adversely affected by invasive plants.

Effects of Alternative B

Direct and Indirect Effects

Under alternative B a total of 2,124 acres would be treated with herbicides, including 1,281 acres of broadcast application and 843 acres of spot treatments during the first year of treatment. Future treatments would be determined by the effectiveness of the initial herbicide treatments, and it is expected that as existing infestations are reduced, a combination of herbicide and non-herbicide methods would be used. Due to the ability to use aminopyralid and thus broadcast spray more area, Alternative B is expected to include less future manual and mechanical treatments than alternatives C or D. See chapter 3.1.4 for a discussion about how alternatives C and D may result in more repeated entries.

Effects of manual, mechanical and biocontrol treatments would be similar to those described previously in the Effects Common to All Action Alternatives section. Because alternative B would have fewer manual/mechanical treatments and considering these treatments pose a greater risk of disturbance to wildlife than herbicides, the likelihood of disturbance or mortality during treatment is reduced under this alternative. The likelihood of direct effects are further reduced, when you consider that 1 percent or less of the affected habitats would be treated (table 61), existing sites are small and scattered, and approximately 80 percent of known sites occur along roads, which provide less preferred habitat for many wildlife species. Finally, using the implementation process described under section 2.4.2., Forest Service personnel would develop annual treatment prescriptions for all existing and new (EDRR described below) invasive plant infestations. This would include identification of wildlife species of local interest or their habitats and implementation of appropriate pdfs, including modification of treatment methods/timing if necessary to reduce potential risks. Collectively for these reasons the likelihood of mortality for any wildlife species is low and any disturbance would be short-term in nature.

Effects of herbicide application would be similar to those described previously in the Effects Common to All Alternatives section. None of the first-choice herbicides used resulted in an acute or chronic dose that exceeded the toxicity index for any group of wildlife species. While other herbicides could be used in subsequent years to achieve objectives, with implementation of pdfs, Forest standards and treatment buffers, and considering annual treatment prescriptions would identify species/habitats of concern and modify treatment type and timing if necessary; there are no adverse effects from herbicide exposure anticipated under this alternative.

Effects to habitat vary by the size of the infestation and effectiveness of treatment. For example, while bare ground can be created in dense patches of invasive plants, effects to wildlife would be reduced because these areas do not provide preferred habitat. Considering approximately 250 acres have 50 percent infestation or more, cover would be retained on all sites. Alternative B includes a full range of treatment options, including broadcast spraying and use of aminopyralid near standing water, wetlands and across riparian areas; therefore, it is estimated that treatment effectiveness would be approximately 80 percent. Also alternative B would be most effective at controlling larger infestations should they be detected in the future. As a result alternative B would effectively control invasive plants and promote the long-term maintenance of native vegetation and wildlife, including “at risk” habitat identified in chapter 3.7.2.

Malheur National Forest Land and Resource Management Plan (LRMP) Amendment

The proposed LRMP amendment to add aminopyralid would likely improve the effectiveness of treatment (chapter 3.1.4). This would result in neutral or positive impacts to wildlife on the Malheur National Forest because aminopyralid poses no likely risk to wildlife and would effectively treat invasive plants which can degrade habitat.

Early Detection Rapid Response

In addition to proposed treatments, alternative B would allow treatment of new detections (EDRR), as long as the treatment method is within the scope of this EIS. The treatment of newly found sites adds additional risk factors to wildlife just by adding additional exposure areas. This also expands the treatment into areas that may not have been originally anticipated. However, the implementation planning process identified in chapter 2 would be used with each new infestation site to determine treatment. Also the pdfs provide layers of caution, so even if the exact locations are not known, the potential for adverse effects are minimized. Implementation of pdfs and herbicide-use buffers and treatment limits would work together to provide sideboards to deal with the uncertainty of treating new sites (USDA Forest Service 2008b) and ensure that direct and indirect effects are consistent with those anticipated in the FEIS. Alternative B would be most effective at controlling infestations detected in the future (see chapter 3.1.4).

Effects of Alternative C

Direct and Indirect Effects

Under alternative C, non-herbicide treatments would be increased on 1,389 acres during the first year of treatment, and more repeated manual/mechanical treatments would occur in subsequent years (see chapter 3.1.4 for discussion about why more repeated treatments would be necessary for alternative C). Effects of non-herbicide treatments would be similar to those discussed previously in the Treatment Effects Common to All Action Alternatives section. The likelihood of direct effects are increased somewhat under this alternative because manual/mechanical treatments can increase the likelihood of disturbance to less mobile species. Like alternative B, when you consider that 1 percent or less of the affected habitats would be treated (table 61), existing sites are small and scattered, and approximately 80 percent of the known sites occur along roads, which provide less preferred habitat for many wildlife species, the likelihood of direct effects are low. Potential for effects are further reduced when you consider implementation of pdfs

and that annual treatment prescriptions would be prepared for all new infestations that would identify wildlife species of local interest or their habitats, and treatment methods/timing would be modified if necessary to reduce potential risks. Treatment risks are increased somewhat under this alternative, but collectively for these reasons the likelihood of mortality for any wildlife species is low and any disturbance would be short term.

Effects of herbicide treatments would be similar to those discussed previously in the Treatment Effects Common to All Action Alternatives section. Like alternative B, none of the first year/first choice herbicides resulted in an acute or chronic dose that exceeded the toxicity index for any wildlife species. While other herbicides could be used in subsequent years to achieve objectives, with implementation of pdfs, Forest standards and treatment buffers, and considering annual treatment prescriptions would identify species/habitats of concern and modify treatment type and timing if necessary; there are no adverse effects to wildlife from herbicide exposure anticipated.

Like alternative B, cover would be retained on all treatment sites and there would be little change in wildlife habitat conditions in the short-term. However, requiring only non-herbicide treatments on much of the infested areas would reduce effectiveness compared to using herbicides in combination with non-herbicide treatments (see chapter 3.1.4), and overall treatment effectiveness would be reduced by almost half from that of alternative B. So while implementation of alternative C would help contain or control invasive plants, it would be less effective than alternatives B or D.

Malheur National Forest Land and Resource Management Plan (LRMP) Amendment

The proposed LRMP amendment to add aminopyralid would likely improve the effectiveness of treatment (chapter 3.1.4). This would result in neutral or positive impacts to wildlife on the Malheur National Forest.

Early Detection Rapid Response

Like alternative B, alternative C would allow treatment of new detections (EDRR) as long as the treatment method is within the scope of this EIS. The treatment of newly found sites adds additional risk factors to wildlife just by adding additional exposure areas. This also expands the treatment into areas that may not have been originally anticipated. However, the implementation planning process identified in chapter 2 would be used with each new infestation site to determine treatment. The pdfs provide layers of caution so that even if the exact locations are not known, the potential for adverse effects are minimized. Implementation of pdfs, buffers and treatment limits all work together to provide sideboards to deal with the uncertainty of treating new sites (USDA Forest Service 2008b) and ensure that direct and indirect effects are consistent as discussed in the alternative and species-specific analysis presented. Alternative C would be the least effective of the action alternatives at controlling future infestations due to the restrictions on treatment.

Effects on Alternative D

Direct and Indirect Effects

Alternative D is similar to alternative B, except that aminopyralid would not be approved for use. As a result, use of chlorsulfuron (a lowest risk herbicide) would increase and some moderate-risk herbicides (glyphosate and picloram) would be used as first year/first choice treatments. Use of herbicides other than aminopyralid would also require increased use of spot application within all habitats except sagebrush. Effects of treatment would be similar to those described previously in the Effects Common to All Action Alternatives section. While the increase in spot application would increase risks of direct effects from those of alternative B, when you consider that 1 percent or less of any of the affected habitats would be treated (table 61), existing sites are small and scattered, and approximately 80 percent of the known sites occur along roads, which provide less preferred habitat for many wildlife species, the likelihood of direct

effects are low. Potential for effects are further reduced when you consider implementation of pdfs and that annual treatment prescriptions would be prepared for all existing and new infestations that would identify wildlife species of local interest or their habitats, and treatment methods/timing would be modified if necessary to reduce potential risks. Treatment risks are increased somewhat under this alternative, however, like the other action alternatives, the likelihood of mortality for any wildlife species is low and any disturbance would be short term.

Use of moderate to higher risk herbicides would occur on approximately 788 acres or 37 percent of infested acres treated during the first year. Implementation of pdfs, Forest standards and treatment buffers and considering annual treatment prescriptions would identify species/habitats of concern and modify treatment type and timing if necessary, no adverse effects to wildlife from herbicide exposure anticipated.

Proposed treatments would reduce existing infestation of invasive plants across the project area and promote native wildlife habitat. Like alternatives B and C, reductions in cover would be small and scattered and there would be little change in the availability of wildlife habitat. Because aminopyralid is not approved under this alternative, treatment effectiveness of the sites would be approximately 66 percent of the sites treated. Much of the reduction in effectiveness would occur along streamsides due to increased buffers if aminopyralid is not approved. While alternative D would be effective at reducing invasive plants, it would be less effective at promoting the long-term maintenance of native vegetation and wildlife habitat than alternative B.

Malheur National Forest Land and Resource Management Plan (LRMP) Amendment

No amendment is proposed for alternative D.

Early Detection Rapid Response

Like alternative B, alternative D would allow treatment of new detections (EDRR), as long as the treatment method is within the scope of this EIS. The treatment of newly found sites adds additional risk factors to wildlife just by adding additional exposure areas. This also expands the treatment into areas that may not have been originally anticipated. However, the implementation planning process identified in chapter 2 would be used with each new infestation site to determine treatment. The pdfs provide layers of caution so even if the exact locations are not known, the potential for adverse effects are minimized. Project design features, herbicide-use buffers and the implementation planning process all work together to provide sideboards to deal with the uncertainty of treating new sites (USDA Forest Service 2008b) and ensure that direct and indirect effects are consistent with discussed in the alternative and species specific analysis presented. Alternative D would be less effective in reducing invasive plants than alternative B

Cumulative Effects of the Action Alternatives

Potential cumulative effects to wildlife are assessed for each of the action alternatives evaluated in the EIS, as well as for the individual species evaluated. The cumulative effects analysis area includes all lands within the project area proclamation boundary. This area was selected because it contains a diversity of habitat conditions, is large enough to assess species with large home ranges as well as migratory species, and would allow for assessment of potential impacts on lands of other ownerships. Because future projects can only be reasonably predicted for the next 12 years, potential cumulative effects are evaluated out to the year 2025.

Past management activities on the Forest in combination with a conservative approach to invasive plant treatment has resulted in an increase in invasive plant infestation across the Forest. On-going and foreseeable future actions will continue to promote the spread of invasive plants. Activities on NFS lands that could further increase the spread of invasive plants and affect wildlife habitat including prescribed burning, timber harvest and reforestation treatments, fuel reduction, plantation thinning, road closures and maintenance and decommissioning, facility/recreation projects, and grazing. These activities will occur

Forest-wide, are spread out over 60 sub-watersheds (HUC6), and would be implemented over the next 10 years. A complete list of future activities can be found in the project file. Treatments that don't result in disturbance would result in little increase in the spread of invasive plants. Also with implementation of Forest standards that require re-seeding with native vegetation, use of weed free hay and equipment cleaning provisions, the likelihood invasive plants would spread due to recreation/facility construction activities is reduced. Consequently of the anticipated future activities, timber harvest, fuel reduction, recreation, burning and grazing have the most potential to increase the spread of invasive plants.

While future management activities would comply with Forest standards designed to reduce the spread of invasive plants (e.g. equipment cleaning clauses and use of weed-free seed during re-vegetation), disturbance and increased levels of light would promote establishment of invasive plants on many of the lands affected by management. While it is not anticipated that grazing use would change, on-going grazing would also continue to promote the spread of invasive plants, particularly in dry forest and shrub-steppe habitats. Continued grazing would also reduce wildlife cover and forage, although with implementation of allotment management plans and allowable use standards, it is expected that habitat would be maintained. Recreational activity on NFS land is expected to increase and on-going activities across all ownerships would continue to cause ground disturbances that can contribute to the introduction, spread and establishment of invasive plants on NFS lands (USDA Forest Service 2005a).

In addition to activities on NFS lands, herbicides are commonly applied on lands of other ownerships for a variety of agricultural, landscaping and invasive plant management purposes. Herbicide use occurs on tribal lands, state and county lands, private forestry lands, rangelands, utility corridors, road rights-of-way, and private property. The Bureau of Land Management has also proposed invasive plant treatments using herbicides on lands in Oregon, although their proposals are not site specific and cannot be used to model cumulative effects at the watershed scale.

Under all action alternatives, some level of invasive plant control would occur on 2,124 acres and of this, 1,067 acres occur within watersheds where some future management activity is anticipated. Watersheds that contain both invasive plant treatments and future management activities are displayed in table 62.

Table 62. Watersheds containing planned future activities and invasive plant treatments

Watershed	Future Activity[1]	Invasive Plant Treatments[2]
Birch Creek	P	1
Bosenberg Creek	G	4
Bridge Creek	T, R,G	26
Crane Creek	T,B,	12
Deardorff Creek	T	11
Dry Cr. John Day River	P	<1
Elk Creek	T,B	24
Emigrant Creek	T,R	44
Granite Boulder Creek	R,P	120
Long Creek	P	1
Indian Creek	P	1
Lake Creek	G	3
Lick Creek	G	8
Little Boulder Creek	T,B,R	139
Long Creek	P	18
Lower Bear Creek	T,B	1
Lower Deer Creek	T,	1
Lower Scotty Creek	T,B	3
Middle Bear Creek	T,B	2
Middle Silvies River	R	6
Mill Creek	R	145
North Basin	T,B,F,R	15
Pine Creek	B,R,	79
Slide Creek	P	6
Starr Creek	T,F,B	16
Summit Creek	T,B,G	15
Upper Big Creek	G	5
Upper Camp Creek	G	14
Upper Deer Creek	P	1
Upper Fox Creek	P	22
Upper Long Creek	P	18
Upper Malheur River	P	45
Upper South Fork John Day River	T	46
Upper Silver Creek	T,B,R	20
Upper Silvies River	T,B,F,R,P	56
Van Aspen-Silvies River	T,B	15
Vinegar Creek	T,B,R	81
Wiley Creek	P,B,R	2
Wolf Creek	T	38
Total Invasive Plant Treatment		**1,067**

1 – Activity Codes (T)-Timber harvest, (B)-Burning, (F)-Fuel Reduction, (R)-Recreation/facility, (P)-Plantation thinning, (G)-Grazing improvements. 2 – Invasive plant treatments that don't occur in watersheds with future treatments are not displayed.

Thirty-nine watersheds would receive invasive plant treatments, as well as future management. Of these, 20 would receive harvest, burning or fuel treatments that are most likely to promote the spread of invasive plants. One percent or less of all watersheds are proposed for treatments. As a result unaffected habitat is widely available and implementation of anticipated future activities combined with proposed actions is not expected to reduce the availability of wildlife habitat or significantly affect wildlife. Additionally, implementation of the action alternatives would reduce the seed source within many of the watersheds.

In addition to proposed treatments, all action alternatives would allow treatment of new detections (EDRR), as long as the treatment method is within the scope of this EIS. The treatment of newly found sites adds additional risk factors to wildlife just by adding additional exposure areas. This also expands the treatment into areas that may not have been originally anticipated., The decision process identified in the EIS would be used with each new infestation site to determine treatment. In addition, pdfs have been set up to provide layers of caution so that even if the exact locations are not known, the potential for adverse effects are minimized. Implementation of pdfs, buffers and treatment limits (i.e. leaving stream corridors untreated) all work together to provide sideboards to deal with the uncertainty of treating new sites (USDA Forest Service 2008b).

Since wildlife move and migrate, some species could be exposed to herbicides on NFS lands, as well as adjacent lands that are within their home range or along travel corridors. Consequently species could be exposed to the same herbicide on multiple ownerships, or a combination of different herbicides. Wildlife could also be exposed to other chemicals, such as insecticides, rodenticides, fungicides, and others. While potential for multiple herbicide exposures to wildlife exists, the risk that adverse effects would occur depends on a number of factors such as feeding strategy, seasonal activity, and the types and amounts of herbicides used. The following considerations collectively reduce potential impacts from herbicide exposure on wildlife:

- While total acres of herbicides proposed on lands of other ownerships are not available, counties are responsible for controlling noxious weeds along county roads and other county property outside of and within the Forest. They also work with conservation districts, weed management areas, and watershed councils to control noxious weeds on private property. So while additive herbicide exposures are possible if herbicide is used on neighboring lands during the same day as NFS land are treated, activities occurring on the Forest Service, other federal agencies, states, and counties would be coordinated, making treatment overlaps unlikely.
- The herbicides proposed for use a do not significantly bio-accumulate (R6 2005 FEIS). For additive doses to occur, two exposures would have to occur at approximately at the same time. At proposed application rates and with implementation of pdfs, it is unlikely that any species would receive additive doses beyond those evaluated for chronic and acute exposures in the USDA Forest Service risk assessments.
- The likelihood that wildlife would receive a toxic level of herbicides are reduced because herbicides used are excreted within 48 hours and herbicide persistence is reduced through implementation of pdfs.
- While pdfs add a measure of protection for non-target wildlife on NFS lands, wildlife may be more vulnerable on lands of other ownerships where protective measures are unknown. However treatments are spread out over 100 HUC 6 watersheds, which vary in size between 10,000 and 38,000 acres and 1 percent or less of all affected watersheds would be proposed for treatment. The widely scattered nature of proposed treatments, combined with the small size of infestations (over 80 percent less than one-quarter acre), reduce the likelihood that any wildlife species that utilizes multiple ownerships would exposed to toxic levels of herbicide due to proposed treatments.

- The management direction included in all action alternatives as well as the environmental conditions and animal behavior would tend to minimize actual impacts for EDRR. Prior to implementation choices could be made to avoid situations that could cause harm to wildlife. For example, certain herbicides could be avoided in specific areas or times of the year where/when species that utilize grass such as amphibians may be at risk, or more specific application methods could be used. These factors would be evaluated prior to treatment and pdfs applied that modify treatment methods/timing if necessary to reduce potential impacts to wildlife. Effects of treatments each year under early detection-rapid response, by definition, would not exceed those predicted for the most ambitious conceivable treatment scenario. This is because the pdfs do so much to control the potential for adverse effects and because if the most ambitious treatment scenario were implemented, the potential for spread into new areas would be greatly reduced.

Collectively for the above reasons, and due to the small amount of habitat affected within any watershed and widespread availability of unaffected habitat, it is unlikely that any proposed treatments would measurably contribute to any other activities on private land that would result in significant effects to wildlife.

Effects to Federally Listed Species

Effects determinations for federally listed species are shown in the following table.

Table 63. Draft findings and determinations for ESA-listed wildlife species in the project area

Species	Action Alternative Determination	Reason
Canada Lynx	No Effect	Lynx have not been documented on the Forest and suitable habitat would be unaffected by treatments.
North American Wolverine	No Effect	Wolverine use of the project area is low and use would not occur within treatment sites.

Canada Lynx

Direct and Indirect Effects and Determination

The Malheur National Forest is categorized as a “peripheral area” based on the Draft Lynx Recovery Outline (USDI FWS 2005a) and there is no documentation of lynx reproducing in the state of Oregon. The Forest has not had a verified lynx observation since 1999, therefore the Forest is considered “unoccupied” habitat (USDI FWS 2006a). Currently only eight acres of foraging and den habitat are proposed for treatment. Due to the small amount of suitable habitat affected and considering the project area is not considered occupied lynx habitat, there would be no direct, indirect or cumulative effects and implementation of the action alternatives would have No Effect on lynx.

North American Wolverine

Direct and Indirect Effects and Determination

Wolverines occur in remote areas and have not been recently documented on the Forest. Also there is less than an acre of invasive plants proposed for treatment within potential den habitat. Wolverine utilize higher elevations during the snow free period to avoid high temperatures and human activity (Ruggiero et al 1999), thus direct effects to wolverine from proposed treatments are not anticipated.. Similarly, because they prefer closed-canopy forest habitat at upper elevations, wolverine habitat would not be adversely affected by invasive plants. As a result there are no direct, indirect, or cumulative effects to this species anticipated and implementation of alternatives B through D would have No Effect on the wolverine.

Effects to Forest Service Sensitive Species

Table 64. Sensitive Species determinations and rationale

Species	Action Alternative Determination	Rationale
Gray Wolf	MIIH[1]	Unlikely to be present in treatment areas. Future den and rendezvous sites protected.
Pygmy Rabbit	MIIH[1]	Not documented within the project area and unlikely to be present in treatment areas. Project design features minimize potential effects from herbicide exposure and treatment. Treatment would promote native habitat.
Townsend's Big-eared Bat	No Impact	This species would not be present during treatment. Foraging behavior and project design features make herbicide exposure highly unlikely.
Pallid Bat	No Impact	Not present during treatment. Foraging behavior and project design features make herbicide exposure highly unlikely
Fringed Myotis	No Impact	Not present during treatment. Foraging behavior and project design features make herbicide exposure highly unlikely
Bald eagle	No Impact	Few invasive plant acres near suitable nesting, foraging or roost habitat. Project design features effectively reduce potential impacts to nesting or roosting birds. At proposed application rates and methods, no adverse effects from herbicide exposure anticipated.
American peregrine falcon	No Impact	No known nests within the project area. Project design features make disturbance or exposure to herbicides unlikely.
Grasshopper Sparrow	No Impact	Not documented within the project area. Project design features restrict activities within occupied habitat and make herbicide exposure unlikely. Suitable habitat maintained.
Wallowa Rosy Finch	No Impact	Not present in treatment areas. Suitable habitat not proposed for treatment.
Greater sage grouse	MIIH[1]	Nesting not documented within the project area. Project design features restrict activities to breeding birds and reduce the likelihood of disturbance or herbicide exposure. Suitable habitat maintained.
Bufflehead	No Impact	Not present in treatment areas. Project design features make herbicide exposure highly unlikely. Suitable habitat maintained.
Upland sandpiper	MIIH[1]	Nesting not recently documented on the Forest. Project design features reduce treatment and herbicide exposure effects within occupied habitat. Suitable habitat maintained.
Bobolink	No Impact	Not documented within the project area. Project design features minimize potential for effects and make herbicide exposure highly unlikely. Suitable habitat maintained.
Lewis' and white-headed woodpeckers.	MIIH[1]	Nest habitat would not be affected. Foraging behavior and project design features make herbicide exposure unlikely. Low likelihood of disturbance.
Columbia spotted frog	MIIH[1]	Low likelihood of disturbance. Project design features restrict treatment in suitable breeding habitat and make

Species	Action Alternative Determination	Rationale
		herbicide exposure unlikely. Suitable breeding habitat maintained.
Shortface lanx	No Impact	Not present in treatment areas.
Johnson's hairstreak	No Impact	Not present in treatment areas.
Silver-bordered fritillary	MIIH[1]	Occurrence within the project area is unlikely. Project design features restrict treatment within occupied habitat and make herbicide exposure unlikely. Suitable habitat maintained.
Haney basin duskysnail	No Impact	Not present in treatment areas. Project design features protect future sites and make herbicide exposure highly unlikely.
Columbia clubtail	No Impact	Not documented in the project area. Project design features restrict treatment within breeding habitat and herbicide exposure highly unlikely.

1 – MIIH – May impact individuals or habitat (MIIH), but are not likely to lead to a trend toward federal listing"

Gray Wolf

Direct and Indirect Effects

Treatment - No known denning or rendezvous sites on or near the Malheur National Forest. While no packs have become established, transient individuals may occasionally travel through looking for new territory or mates, and there is potential for wolves to become established on the project area in the future.

Direct effects from invasive plant treatments include disturbance caused by noise, people and vehicles. However, invasive plant projects involve very short-term disturbance with few people and might only be repeated once in the same growing season. Although wolves will travel over large distances, they are most likely to occur in wilderness and roadless areas, away from human disturbance. These areas tend to have minimal invasive plant infestations so the likelihood of disturbance is low. Additionally project design features are in place that prevents invasive plant treatments to occur in close proximity to den or rendezvous sites. As a result it is unlikely individual animals would be affected by treatment and if disturbance were to occur, it would be limited to short-term avoidance by foraging or transient individuals.

While proposed treatments would help maintain habitat for elk, deer or other prey species, there would be little change in gray wolf habitat.

Herbicides - None of the proposed herbicides would result in an acute exposure that exceeds the toxicity index, however chronic exposures to carnivores could occur at the typical and highest application rate with triclopyr or at the highest application rate of NPE-based surfactants. First-choice herbicides under alternatives B and C would pose no risk to wolves. While alternative D would use first-choice herbicides with NPE-based surfactants, with implementation of F2, application would be restricted to 0.5 lbs. of active ingredient per acres and there are no adverse effects from herbicide exposure anticipated. pdf F2 limits the use of NPE-based surfactants, and a Malheur National Forest LRMP standard limits triclopyr to selective applications (no broadcast). Triclopyr is not a first-choice herbicide in any alternative.

Few treatments are proposed within preferred wolf habitat. Wolves forage over large areas and would not forage exclusively on contaminated prey; there are no adverse effects from herbicide exposure anticipated under any alternative.

Cumulative Effects

While on-going and future activities could result in disturbance to wolves, it is expected any future den and rendezvous sites would be protected from treatment. Also many of the anticipated future treatment would be expected to promote habitat for big game. So while future treatments could result in short-term disturbance to foraging or transient individuals, because proposed treatments would help to maintain native big game range, and considering adverse effects from herbicide exposure are not anticipated, none of the alternatives would measurably contribute to any other past, on-going or foreseeable future activity and result in significant effects to the wolf.

Summary and Determination

To date gray wolves have not been confirmed on the Malheur National Forest, although use is likely and it is possible that short-term disturbance could occur due to proposed treatments. As a result, and based on the above analysis and the following rationale, implementation of alternatives B through D "may impact individuals or habitat (MIIH), but are not likely to lead to a trend toward federal listing" the gray wolf.

- Project design features would prevent disturbance to any den or rendezvous sites established on the Forest.
- At proposed application rates and with implementation of pdfs, there are no adverse effects from herbicide exposure anticipated.
- Invasive plants and invasive plant treatments are less likely to occur in preferred remote habitat.
- Any disturbance from invasive plant treatment would be short-term in nature.
- Treatment would help maintain native plant communities and preferred big game habitat.

Pygmy Rabbit

Direct and Indirect Effects

Treatment - All proposed treatments have the potential to result in disturbance during implementation. Because less mobile young would be in burrows underground there is no direct mortality anticipated. Should rabbits occupy the forest in the future, with implementation of pdf J-6c, the timing, location and method of treatment be coordinated with a biologist in suspected use areas and any direct effects would be limited to short-term disturbance during treatment.

Loss of habitat for the pygmy rabbit could occur with expansion of invasive plants on rangelands (Weiss and Verts 1984), therefore, proposed invasive plant treatments would result in a beneficial effect to pygmy rabbit habitat by reducing the future spread of invasive plants and a possible loss of habitat.

Herbicides - There are no chronic exposures of concern with any of the proposed herbicides; although NPE-based surfactants applied at the highest rate could result in adverse effects from herbicide exposure. With implementation of F2, NPE-based surfactants would be applied below typical application rates. As a result and with implementation of pdf J6-a, which restricts treatment within sites suspected to contain burrows; there are no adverse effects from herbicide exposure anticipated.

Cumulative Effects

Anticipated cumulative effects are discussed by alternative above. Because of the small size of their home range (Heady and Laundre 2005), it is unlikely they would be affected by herbicide treatment on lands of other ownerships. Also except for continued grazing and allotment improvements, future activities occur away from suitable habitat. As a result and considering grazing use is not expected to change, and that treatment is expected to help maintain suitable habitat, none of the alternatives would measurably

contribute to any other past, on-going or foreseeable future activity and result in significant effects to the pygmy rabbit.

Summary and Determination

The pygmy rabbit has not been documented on the forest. While short-term effects from treatment are possible should they become established in the future, based on the above analysis and the following rationale, implementation "may impact individuals or habitat" (MIIH), but are not likely to lead to a trend toward federal listing." for the pygmy rabbit.

- First-year treatment proposes 10 acres of suitable habitat.
- At proposed application rates and with implementation of pdfs, there are no adverse effects from herbicide exposure anticipated.
- Should use on the forest occur in the future, project design features would modify treatment if necessary to reduce potential impacts.
- Proposed treatments would contain or control invasive weed infestations and help to maintain native sagebrush habitat over the long-term.

Townsend's Big-eared Bat, Pallid Bat and Fringed Myotis

Direct and Indirect Effects

Treatment - While suitable habitat would be treated across the Forest, because bats either roost in structures or in the recessed crevices in snags during the day, and forage at a time when treatment would not occur, the likelihood that a bat would be affected by treatment is remote.

Herbicides - Acute exposures of concern to insectivorous mammals could occur with NPE-based surfactants applied at the typical or highest application rate, or with use of picloram or glyphosate at the highest application rate. With implementation of pdf F2, NPE-based surfactants would be applied below the typical application rate and picloram and glyphosate would not be broadcast sprayed at the highest application rate. As a result, and considering bat foraging behavior (i.e., forage over large areas in a single evening) further reduces the likelihood of exposure, there are no adverse effects anticipated.

Cumulative Effects

Anticipated cumulative effects are discussed by alternative above and include increased exposure to herbicides on land ownerships and reduction of suitable habitat due to future timber harvest. Less than 1 percent of the watersheds where future treatments would occur are proposed for management. Consequently, suitable unaffected habitat would be available within all affected watersheds. As a result, and considering that bats forage over large areas and would not be exposed to toxic levels of herbicides, none of the alternatives would measurably contribute to any other past, on-going or foreseeable future activity and result in significant effects to the pallid bat, fringed myotis or Townsend's big-eared bat.

Summary and Determination

All alternatives would treat invasive plants in suitable bat habitat. However roosting bats would be unaffected and it is unlikely foraging bats would occur in treatment sites or be adversely affected by herbicides. As a result implementation of the action alternatives would have No Impact on the pallid bat, fringed myotis or on Townsend's big-eared bat.

Bald Eagle

Direct and Indirect Effects

Treatment - Bald eagles are sensitive to human disturbance during the breeding season, particularly within sight distance of nest sites. Consequently human and vehicle presence can cause the birds to leave nests or stay away from the nest long enough to have detrimental effects to eggs or young (USDI FWS 1986). Mechanical methods are more likely to cause effects at greater distances than other treatment methods, because machinery creates louder noise than other methods.

While there are 3 acres of invasive plants proposed within winter roost habitat and 9 acres fall within one-half mile of an eagle's nest, implementation of the following pdfs would reduce or eliminate noise and disturbance to nesting, roosting and foraging eagles.

- pdf J2a – Invasive plant treatments would not occur within 0.25 miles during the nesting season (January 1st through August 31st).
- pdf J2b – Activities above ambient levels would not occur between October 31st and March 31st during early morning or late afternoon near known winter roosts and concentrated foraging areas. Distance to daytime foraging areas would also be avoided.

With implementation of these pdfs there are no direct impacts to eagle nests or reproduction anticipated. While disturbance to roosting or foraging eagles is possible, given the small amount of land along waterbodies proposed for treatment (67 acres), the likelihood of disturbance is remote.

Herbicides - The results of exposure scenarios indicate that no herbicide or surfactant proposed for use poses a plausible risk to birds from eating contaminated fish. All expected doses to fish-eating birds for all herbicides and NPE are well below any known no-observable-adverse-effect-level (NOAEL) (see Appendix P of the R6 2005 FEIS). Herbicide would not reach the upper canopies of mature trees where bald eagles nest, and with implementation of pdf J2-a, eagles would not be directly sprayed or encounter vegetation that has been sprayed. As a result there are no adverse effects from herbicide exposure anticipated.

Cumulative Effects

Anticipated cumulative effects are discussed by alternative above and include possible herbicide exposure on all land ownerships, or modification of nest habitat due to proposed timber harvest. All future activities would be in compliance with bald eagle and golden eagle management guidelines (USDI Fish and Wildlife Service 2007b) and no impacts to nesting birds or reproduction are anticipated. While it is possible that eagles could be exposed to herbicides on lands of other ownerships, even if a bird fed for a lifetime upon fresh water fish that had been contaminated by an accidental spill of herbicide, they would not receive a dose that exceeded any known NOAEL. As a result, and considering that that the risk of adverse effects from proposed treatment have been effectively eliminated through implementation of pdfs, no alternative would measurably contribute to any other past, on-going or future activity and result in significant effects to the bald eagle.

Summary and Determination

Invasive plant treatments are proposed in 3 acres of eagle winter roost habitat and on 9 acres within one-half mile of known nests. Based on the above analysis and the following rationale, implementation of the action alternatives will have No Impact to bald eagles:

- Implementation of project design features would effectively eliminate the likelihood that nesting or winter roosting eagles would be affected by disturbance associated with invasive plant treatment.

- Invasive plant treatments would not result in the removal of bald eagle nests or roost trees, or affect foraging habitat.
- With implementation of pdfs there are no adverse effects to eagles from herbicide exposure anticipated.
- Projects conducted that are more than a quarter-mile from a nest, or a half-mile line of sight distance from a nest, and do not result in the modification of eagle habitat, or result in noise above ambient levels, should have no effect on bald eagles (FWS 2003a).

American Peregrine Falcon

Direct and Indirect Effects

Treatment - While suitable habitat exists, there are no known peregrine falcon nests on the Malheur National Forest. Because peregrine falcons nest on cliffs away from any known invasive plants, future nests would not be impacted by any of the proposed treatments. The following pdfs were designed to reduce the possibility that nesting birds or their young would be affected by proposed activities:

- J3- a - Seasonal restrictions, which are based on elevation and proximity to the nest will be applied near known nests sites and will be implemented until at least 2 weeks after all young have fledged, including;
- J3-b – All invasive plant treatments would be restricted within 0.5 miles of peregrine falcon nest during the nesting season (based on J3-a).
- J3-c – Invasive plant treatments involving motorized equipment or vehicles would be seasonally prohibited between 0.5 miles and 1.5 miles of known nests during the nesting season (based on J3-a).
- J3-d- Non-mechanized or low-disturbance invasive plant treatment activities may occur between 0.5 miles and 1.5 miles of known nests during the nesting season, but would be coordinated with a wildlife biologist to identify mitigation measures, if necessary.

With implementation of the above pdfs there are no effects to nesting birds or their young from proposed treatments anticipated. Also, due to the small amount of habitat proposed for treatment, and widespread availability of unaffected habitat, the likelihood that foraging birds would be affected is remote.

Herbicides - The “fish-eating bird” scenario and the “mammal-eating bird” were used as surrogate scenarios to determine potential herbicide effects. No herbicide or NPE dose exceeded the toxicity indices for fish eating birds. Under the small mammal eating bird scenario, only NPE exceeded the NOAEL at the highest application rate. With implementation of pdf J2, applications would not exceed 0.5 lbs. of active ingredient per acre. As a result and considering that a peregrine falcon feeding on birds would not likely receive a chronic dose of herbicide from its prey, because the herbicides proposed for use are rapidly excreted from animals and do not bio-accumulate, it is unlikely birds would be exposed to harmful levels of herbicides under any alternative.

Cumulative Effects

Anticipated cumulative effects are discussed under the alternative section above and include possible herbicide exposure on lands of other ownerships. Also hexachlorobenzene (HCB), the contaminant in picloram (alternative D), and to a lesser extent clopyralid, does bio-accumulate in animal tissue; however it is present in very small amounts (picloram, 8 parts per million and clopyralid, less than 2.5 parts per million). The risk of bio-accumulation of HCB from picloram and clopyralid use is therefore very low. The R6 2005 FEIS states that HCB is a ubiquitous and persistent chemical in the environment and the amount released from Forest Service use would be inconsequential in comparison to existing background

levels and annual releases from manufacturing. However, use of picloram and clopyralid in remote locations could constitute the primary source of HCB in those areas. Monitoring of peregrine falcons in the Pacific Northwest has revealed HCB in their blood samples, and peregrine populations in the PNW appear to continue to be affected by contaminants, although not HCB specifically. Eggshell thinning induced by DDE, the metabolite of DDT, affect populations in the Pacific Northwest and elsewhere, and residual levels of DDE continue to be detected in some peregrines (Henny et al. 1996). Reproductive failure at peregrine nests has also occurred in Oregon due to eggshell thinning (Peterson 2006). However with implementation of pdf J3-e the use of picloram and clopyralid is limited to one application per site per year within secondary nest zones. As a result and because broadcast application is restricted to the typical application rate, the likelihood for HCB contamination is remote and discountable.

Analysis in the R6 2005 FEIS found that no herbicide dose exceeded the toxicity indices for fish eating or mammal eating birds at highest application rates in the maximum exposure scenarios. As a result, and with implementation of pdfs, none of the herbicides proposed would result in a level of concern and no alternative would measurably contribute to any other past, on-going or future activity and result in significant effects to the peregrine falcon.

Summary and Determination

There are currently no known nest sites on the Forest. Should a nest become established in the future, implementation of project design features would ensure that nesting peregrine falcons would be not be adversely affected by treatments or be exposed to toxic levels of herbicide. Implementation of the action alternatives would have No Impact to peregrine falcons.

Grasshopper Sparrow

Direct and Indirect Effects

Treatment - Grasshopper sparrows are not known to occur within the project area. Should they become established in the future, pdf J9-a restricts treatment within occupied habitat and there are no impacts to nesting birds or young anticipated. It is unlikely that foraging or migrating birds would be affected because of the small amount of habitat proposed for treatment (71 acres).

Invasive plants can adversely affect habitat for some grassland birds such as the grasshopper sparrow (Scheiman et al 2003). Treatments under the action alternatives would help to contain or control existing as well as future infestations and maintain native grassland habitat.

Herbicides - Risk of effects from herbicide exposure was evaluated using the insectivorous bird scenario. For an acute exposure at typical and highest application rates triclopyr and NPE-based surfactants exceeded a dose of concern, whereas glyphosate exceeded the NOAEL at the highest application rate. Data was lacking to evaluate a chronic exposure of clopyralid, glyphosate, picloram, sethoxydim, sulfometuron methyl, triclopyr and NPE-based surfactants on small birds consuming insects. The Malheur National Forest LRMP restricts use of triclopyr to selective methods only, whereas pdf F2 restricts broadcast application of clopyralid, glyphosate, picloram, sethoxydim and sulfometuron methyl to typical application rates. With implementation of these design features and considering the small size and scattered nature of proposed treatments sites (scattered across 40 watersheds), unaffected suitable habitat is available and it is highly unlikely that a bird would receive an acute or chronic exposure. As a result there are no adverse effects from herbicide exposure anticipated under any alternative.

Cumulative Effects

Anticipated cumulative effects are discussed by alternative above. With the exception of continued grazing, there are few future management activities that would occur within suitable grasshopper sparrow habitat. While they could be exposed to herbicides applied on lands of other ownerships, due to the small

and scattered nature of treatment sites and small amount of habitat proposed for treatment, it is unlikely a bird would receive multiple exposures. As a result, and considering treatment would not occur within occupied habitat during the nesting season, none of the alternatives would measurably contribute to any other past, on-going or future activity and result in significant effects to the grasshopper sparrow.

Summary and Determination

Proposed treatment would contain and control existing and future infestations of invasive plants and help maintain native grassland communities and suitable grasshopper sparrow habitat over the long term. While suitable grasshopper sparrow habitat is proposed for treatment, nesting has not been documented on the forest and project design features are in place that restricts treatment within occupied habitat should they become established in the future, therefore, implementation of the action alternatives would have No Impact on the grasshopper sparrow**.**

Wallowa Rosy Finch

Direct, Indirect and Cumulative Effects

The Wallowa rosy finch occupies upper elevation sites away from primary invasive weed vectors. As a result there are no treatments proposed within suitable habitat and it is unlikely they would be affected by future treatments. As a result there are no direct, indirect effects or cumulative effects from treatment anticipated under any alternative.

Summary and Determination

The Wallowa rosy finch has not been documented on the Forest and it is unlikely that high elevation habitat would be affected by invasive plants, or treatment. As a result implementation of the action alternatives would have No Impact to this species.

Greater Sage Grouse

Direct and Indirect Effects

Treatment - While there are no known leks or brood rearing habitat on the Forest, sage grouse are known to use the project area. Documentation of use is incidental and scattered. About 79 acres of mapped infestations are within the 139,500 acres of suitable habitat for sage grouse within the project area.

Sage grouse are sensitive to disturbance caused by noise, people and vehicles. All treatment methods could cause some disturbance to sage grouse. Should a lek be discovered any time during the life of the project, the following project design features would reduce adverse impacts to nesting birds.

- pdf J4-b - Human activities within 0.3 mile of leks will be prohibited from the period of one hour before sunrise until four hours after sunrise and one hour before sunset until one hour after sunset from February 15 – May 15.
- pdf J4-c - Do no conduct any vegetation treatments or improvement projects in breeding habitats from February 15 – June 30.

With implementation of these pdfs and considering the marginal nature of sage grouse breeding habitat on NFS lands, no effects to breeding birds or reproduction is expected.

Disturbance to foraging birds could occur. However due to the small size and widely scattered nature of treatment sites, and widespread availability of adjacent unaffected habitat, disturbance effects would be minimal and short-term (one day). Sage grouse would likely avoid of the site during treatment.

Loss of habitat for sage grouse by invasive plant expansion on rangelands can occur (Connelly et al. 2000). Because all alternatives would contain or control existing and future invasive plant infestations, native sagebrush communities and suitable sage grouse habitat would be maintained.

Herbicides - Adult sage grouse consume vegetation and chicks rely heavily on insects, thus, herbicide exposure was evaluated using a large vegetation-eating bird, as well as a small bird consuming insects.

For adult birds and chicks at typical application rates, only triclopyr (if broadcast sprayed) and NPE surfactants exceeded the acute toxicity thresholds, whereas glyphosate exceeded a dose of concern at the highest rate for small birds consuming insects. A Malheur National Forest LRMP standard restricts application to triclopyr to selective techniques or spot treatment and with implementation of pdf F2, NPE-based surfactants would only be applied at a rate of 0.5 lbs. active ingredient per acre and glyphosate would not be broadcast sprayed above typical application rate. Additionally, pdf J4-a restricts the use of NPE-based surfactants in areas where sage grouse may forage Collectively for these reasons it is unlikely that adult birds or chicks would receive an acute exposure of concern.

Chronic exposures were also evaluated and at the typical application rate for large birds consuming vegetation triclopyr exceeded a dose of concern, whereas sethoxydim, sulfometuron methyl, glyphosate and triclopyr exceeded the toxicity threshold at the highest application rate. Data is lacking to evaluate a chronic exposure of clopyralid, glyphosate, picloram, sethoxydim, sulfometuron methyl, triclopyr and NPE-based surfactants on small birds consuming insects. While exposure from these herbicides/surfactants are possible, when you consider that; 1) pdf J4-a restricts use of NPE in areas where sage grouse may forage, 2) pdf F2 restricts broadcast application of clopyralid, glyphosate, picloram, sethoxydim and sulfometuron methyl to typical application rates, 3) The Malheur National Forest LRMP prevents broadcast application of triclopyr, 4) Only 79 acres of invasive plant treatment are proposed in suitable habitat and sites are small and scattered across 20 watersheds, and 5) the use of the project area by sage grouse is scattered and incidental, it is unlikely that birds would consume 100 percent of their diet from contaminated insects/vegetation for 90 days and receive a chronic dose of concern. As a result, there are no adverse effects from herbicide exposure anticipated under any alternative.

Cumulative Effects

Anticipated cumulative effects are discussed by alternative above. Other than continued grazing, there are few future management activities anticipated within suitable sage grouse habitat. Because suitable habitat occurs on NFS lands, as well as adjacent private and BLM lands, potential cumulative effects include possible herbicide exposure or disturbance on all ownerships. Due to the small amount of habitat proposed for treatment, treatment restrictions within breeding habitat, and reduced risk of herbicide exposure, none of the alternatives would measurably contribute to any other past, on-going or future activity and result in significant effects to sage grouse.

Summary and Determination

While no sage grouse leks have been documented in the project area, use has been documented and birds could be affected by treatment. Based on the above analysis and following rationale, implementation of the action alternatives “may impact individuals or habitat” (MIIH), but are not likely to lead to a trend toward federal listing.”

- There are no sage grouse leks known to occur on the Forest and National Forest System lands do not provide quality nesting habitat similar to that on adjacent lands. Should a lek be established in the future, pdfs would restrict treatment during the nesting season
- Sage grouse would not be exposed to toxic levels of herbicides.
- Disturbance-related effects to grouse will be short term and unaffected habitat is widely available.

- Proposed treatment would contain and control existing and future infestations of invasive plants and help maintain native sagebrush habitat.

Bufflehead

Direct and Indirect Effects

Treatment - Bufflehead nest in tree cavities and rarely breeds in Oregon. Considering the small amount of habitat proposed for first-year treatments, there are no direct effects from treatment anticipated.

Herbicides - These ducks eat aquatic invertebrates and fish, so risk from herbicide exposure was evaluated using a "fish-eating bird" scenario. Based on available data, no herbicide or NPE-based surfactant exceeded a dose of concern for any exposure (acute or chronic) at any application rate. As a result, no adverse effects from herbicide exposure are anticipated under any alternative.

Cumulative Effects

There are no direct or indirect effects associated with treatment; therefore, none of the alternatives would measurably contribute to any other past, on-going or future activity and result in significant effects to bufflehead.

Summary and Determination

Buffleheads have not been documented breeding within the project area and are unlikely to occur within treatment sites. As a result, and considering that none of the herbicides or surfactants exceeded a dose of concern, implementation of the action alternatives would have No Impact to the Bufflehead.

Upland Sandpiper

Direct and Indirect Effects

Treatment - Approximately 79,000 acres of potentially suitable upland sandpiper habitat occurs on the Malheur National Forest and of this, 72 acres are currently known to contain invasive plants. Broadcast application would occur on 50 percent and 25 percent of the sites under alternatives B and D respectively, whereas manual/mechanical treatments would occur on 68 percent of the sites under alternative C.

Potential effects of invasive plant treatment on upland sandpipers are mainly associated with disturbance that may occur during the nesting season caused by noise, people and vehicles. If birds were to be in the immediate vicinity of treatment, they could be temporarily displaced. Also the cryptic nests of upland sandpipers are susceptible to crushing or trampling by people or vehicles. In order to reduce the likelihood that nests, eggs our young are harmed, the following design feature would be implemented:

- pdf J8-a - No treatment would occur on sites that have historic or recent documentation of Upland Sandpipers during the nesting season (April 1st to August 1st), unless the site has been surveyed and no nesting is occurring.

Upland sandpiper would not receive a toxic dose of herbicide under any alternative. While all action alternatives would reduce invasive weeds, alternative B would provide the most effective control of invasive plants (see chapter 3.14).

With implementation of the above pdf, there are no impacts to nesting birds or their young anticipated. However short-term disturbance to foraging birds outside the nesting season is possible.

Herbicides - Effects of herbicides are the same as those described under grasshopper sparrow and there are no adverse effects anticipated under any alternative

Cumulative Effects

With the exception of continued grazing, there are few future management activities that would occur within suitable upland sandpiper habitat. While they could be exposed to herbicides applied on lands of other ownerships, due to the small and scattered nature of treatment sites and small amount of habitat proposed for treatment, it is unlikely a bird would receive multiple exposures. The proposed herbicides do not bio-accumulate or bio-magnify, thus none of the alternatives would measurably contribute to other past, on-going or future activity and result in significant effects to the upland sandpiper.

Summary and Determination

Upland sandpipers have not been documented breeding on the Forest, but use on adjacent private lands does occur and use of suitable habitat on the Forest is possible. Based on the above analysis and the following rationale, implementation of the action alternatives "may impact individuals or habitat" (MIIH), but are not likely to lead to a trend toward federal listing."

- Breeding upland sandpipers have not been documented on the Forest
- Should a nest be documented, project design features are in place that restricts treatment during the breeding season.
- Herbicide use in any alternative is not likely to result in toxic does to upland sandpiper given the types of herbicides proposed and the pdfs. Lewis and White-Headed Woodpeckers
- Proposed treatment would contain and control existing and future infestations of invasive plants and help maintain native grassland habitat required by upland sandpipers.

Lewis and White-headed Woodpeckers

Direct and Indirect Effects

Treatment - Approximately 275 acres of Lewis's woodpecker and 10 acres of suitable white-headed woodpecker habitat are proposed for treatment. No snags or trees would be removed; so nest habitat would be unaffected. Foraging birds, particularly the Lewis woodpecker, which frequently forages on the ground, could be affected by the noise and disturbance associated with herbicide or non-herbicide treatments under all alternatives. Both species forage over large areas and considering the availability of unaffected habitat, direct effects would be limited to short-term disturbance.

Herbicides - At typical application rates triclopyr and NPE-based surfactants pose an acute risk to birds eating insects. Glyphosate poses an acute risk at the highest application rate, whereas data is lacking to fully assess chronic exposures of clopyralid, glyphosate, picloram, sethoxydim, sulfometuron methyl, triclopyr and NPE-based surfactants on small birds consuming insects. With implementation of Malheur National Forest LRMP standards and pdf F2; application of triclopyr is limited to selective techniques, NPE-based surfactants cannot be applied above 0.5 lbs. active ingredient per acre, and clopyralid, glyphosate, picloram, sethoxydim and sulfometuron methyl cannot be broadcast sprayed above typical application rates. As a result, the likelihood that a bird would be exposed to toxic levels of herbicide is reduced.

The likelihood of exposure is further reduced when you consider that birds forage over large areas and that many of the insects utilized occur within dead wood, under bark or are taken from areas not exposed to herbicides. As a result, birds are not likely to consume an entire day's diet of contaminated insects (acute exposure) or forage exclusively on contaminated insects for 90 days (chronic exposure) and there are no adverse effects from herbicide exposure anticipated under any alternative.

Cumulative Effects

These species could be affected by any activity that reduces snags or downed wood, or modifies the overstory, particularly timber harvest and prescribed burning. As discussed under alternative cumulative effects, timber harvest and invasive plant treatments would occur within 39 watersheds, which include approximately 1,100 acres of treatment. While timber harvest would reduce habitat for some species due to reductions in the overstory, with implementation of Forest standards, a component of snags and downed wood would be retained on all sites. As a result, and considering that proposed treatments would not modify suitable habitat and the low risk of herbicide exposure, none of the alternatives would measurably contribute to any other past, current or foreseeable activity and there are no significant cumulative effects to snag- or downed-wood- dependent species anticipated.

Summary and Determination

Lewis Woodpecker - Approximately 275 acres of suitable habitat is proposed for first-year treatment. No direct effects to nesting birds or reproduction are anticipated and suitable habitat would be unchanged. Because treatment could result in short-term disturbance to foraging birds, implementation of the action alternatives may impact individuals or habitat" (MIIH), but are not likely to lead to a trend toward federal listing".

White-headed Woodpecker - Approximately 10 acres of suitable habitat proposed for treatment. No direct effects to nesting birds or reproduction are anticipated and suitable habitat would be unchanged. Because treatment could result in short-term disturbance to foraging birds, implementation of the action alternatives may impact individuals or habitat" (MIIH), but are not likely to lead to a trend toward federal listing".

Columbia Spotted Frog

Direct and Indirect Effects

Treatment – Invasive plants have been mapped within 52 acres of suitable breeding habitat. Broadcast application of herbicides is proposed on 23 and 4 acres under alternatives B and D respectively, whereas 48 acres of manual treatment would occur under alternative C.

Adult frogs, eggs, and larvae are not likely to be disturbed by invasive plant treatments during the breeding season because they are restricted to aquatic habitat. After breeding however, adults will disperse into adjacent wetland and riparian/upland habitats utilized by frogs. While trampling and direct mortality could occur under all alternatives, with implementation of pdf J5-a, treatment methods, timing and location be coordinated with a biologist prior to implementation when working in occupied habitat. As a result, and considering that frogs are less likely to inhabit areas infested with invasive plants, the likelihood of mortality or short-term disturbance is low.

Herbicides - Data on herbicide effects to amphibians is limited. There is some data to suggest that amphibians may be as sensitive to herbicides as fish (Berrill et al. 1994, Berrill et al. 1997, Perkins et al. 2000), so for the this analysis herbicides that pose potential risk to federally listed fish (as determined by the quantitative estimates from exposure scenarios) will also be considered to pose a risk to amphibians. Results from exposure scenarios indicate that aminopyralid, chlorsulfuron, clopyralid, imazapic, imazapyr, metsulfuron methyl and picloram pose a very low risk to amphibians. While toxicity risks associated with sethoxydim, sulfometuron methyl, glyphosate, triclopyr and NPE-based surfactants are higher, with implementation of Malheur National Forest LRMP standards and pdfs, the likelihood that breeding frogs, eggs and larvae would be exposed to herbicides is reduced.

The likelihood of exposing amphibians depends on the application method, habitat treated, and season of application. Although potential for exposure to toxic levels of herbicide exist, adverse effects to

amphibians are greatly reduced by implementation of pdfs that restrict herbicide application rates, restrict use of moderate to high risk herbicides and require herbicide-use buffers. More specifically 1) project design features (F2, H1, H2, H5, and H8-H10) reduce the likelihood for herbicides to be delivered to waterways in a concentration of concern, 2) herbicide restrictions on certain soil types (H3 and H6) reduce potential for runoff and leaching, 3) restrictions on extent of treatment in a given site (H4, H5 and H7) ensure that herbicides would not be delivered in amounts greater than the SERA risk assessment scenarios and that unsprayed areas provide refugia, 4) spills are extremely unlikely to occur given the many safety precautions in place and 5) when working within occupied or suitable spotted habitat, use of herbicides that pose a risk be restricted and that the treatment methods, timing and location be coordinated with a wildlife biologist. Collectively these pdfs in combination with the use of low risk first year/first choice herbicides will ensure that the Columbia spotted frog is not adversely affected by herbicides.

Adult frogs could be dermally exposed to herbicides by moving through treated vegetation or soil. There is insufficient data to quantify the dose received from exposure to contaminated vegetation or soil, but it is likely to be much less than if the frog was in contaminated water and could easily absorb the solution through its skin. The herbicide-use buffers restrict broadcast application of herbicides within breeding habitat where necessary and require that unsprayed areas be provided to serve as refugia for amphibians (H7 and H8) when treating lakes, ponds or wetlands, and H9 restricts herbicide use nears wells, springs and stockponds.

Cumulative Effects

There would be few if any effects to breeding habitat from ongoing or future timber harvest, burning or fuel treatments. However activities, such as grazing, road maintenance, or recreation can result in disturbance to frog habitat. While proposed treatments could further disturb individuals, effects would be limited to short-term disturbance. Project design features limit the potential for any action alternative to contribute to cumulative adverse effects. Due to their restricted movement, frogs are unlikely to be exposed to herbicides on lands of other ownerships. Also because the herbicides proposed for use are rapidly excreted (even by aquatic organisms), do not bio-accumulate or bio-magnify, there are no adverse effects from herbicide exposure anticipated. As a result, none of the alternatives would measurably contribute to any other past, on-going or future activity and result in significant effects to the Columbia spotted frog.

Summary and Determination

Disturbance to Columbia spotted frog eggs, larvae, or adults during invasive plant treatment would be minor and short term. Implementation of any action alternative “may impact individuals or habitat” (MIIH), but are not likely to lead to a trend toward federal listing.” Adult frogs, eggs, and larvae are not likely to be disturbed by invasive plant treatments during the breeding season because they are restricted to aquatic habitat. Due to the relatively low toxicity of most herbicides proposed, the low concentrations in water that would occur under normal operations, and implementation of pdfs, it is unlikely frogs, eggs or larvae would be exposed to toxic levels of herbicide. If occupied habitat is proposed for treatment, the site would be reviewed by a local biologist and treatment methods modified if necessary to avoid adverse impacts. Proposed treatment would contain and control existing and future infestations of invasive plants and help maintain riparian/wetland habitat.

Shortface Lanx and Harney Basin Duskysnail

Direct and Indirect Effects

Treatment - The shortface lanx is a non-migrant freshwater snail that can be found in the main channel of fast flowing streams and rivers. There would be no mortality or disturbance to the shortface lanx because it is aquatic and inhabits larger streams and rivers.

The Harney basin duskysnail (HBD) inhabits cold springs and runs, as well as adjacent sagebrush habitat. There are no treatments proposed within the Spring Creek watershed that contains the only known documentation of the Harney basin duskysnail within the project area. While it is possible that a site could be affected in the future, with implementation of the following pdf, and considering that treatment would not likely occur within a cold water spring habitat where this species would be found, it is not expected that the Harney basin duskysnail would be directly affected by treatment under any alternative.

- pdf J10-a - If an occupied site is proposed for treatment, a local biologist would be consulted to determine protection measures, if necessary. These measures may include limitations on vehicle entry, modifications to treatment type or timing, or implementation of herbicide-use buffers.

Invasive plant treatments would not remove or alter habitat at the site, nor would treatments result in changes to the hydrologic regime. As a result suitable habitat would be unchanged.

Herbicides - As described above, data on the effects of herbicides to mollusk species is limited. Those evaluated included moderate risk herbicides (picloram and glyphosate), which were not found to pose a risk. The likelihood is further reduced with implementation of pdf J10a, which restricts treatment within occupied Harney basin duskysnail habitat. With implementation of this pdf and considering there are no first-year treatments proposed near the Spring Creek site where this species has been documented there are no adverse effects from herbicide exposure to the Harney basin duskysnail anticipated.

Cumulative Effects

While future grazing may adversely affect the Harney basin duskysnail or its habitat, because proposed treatments would not alter existing habitat, or likely result in exposure to harmful levels of herbicide, none of the alternatives would measurably contribute to any other past, on-going or future activity and result in significant effects to these species.

Summary and Determination

Shortface lanx has not been documented on the Forest, It occupies large fast flowing streams and rivers, it is not adversely affected by invasive plants or treatment. As a result implementation of the action alternatives would have No Impact on the shortface lanx. No treatments are proposed at the site where the Harney basin duskysnail has been documented and pdfs would modify treatment or timing if necessary should an occupied site be proposed for treatment in the future. As a result and considering pdfs would further protect spring and seeps, the action alternatives would have No Impact to the Harney basin duskysnail.

Johnson Hairstreak

Direct, Indirect, Cumulative Effects and Determination

Johnson hairstreak has not been documented within suitable coniferous-forest habitat within the project area, and it is unlikely they would occur within treatment areas. Consequently there would be no direct, indirect or cumulative effects anticipated ,and implementation of the action alternatives would have No Impact on this species.

Silver-bordered Fritillary

Direct and Indirect Effects

Treatment - Of the approximately 22,000 acres of potentially suitable habitat, approximately 34 acres of riparian/wet meadow habitat are known to contain invasive weeds and are proposed for treatment. These sites are generally small in size and scattered across 45 watersheds.

Mechanical, manual and herbicide treatment could harm eggs or larvae, due to physical disturbance on the site. In order to reduce potential impacts pdf J6-b requires that a local wildlife biologist be contacted if treatment is proposed on sites where the silver-bordered fritillary has been documented. Since the butterfly populations fluctuate wildly among meadows and between years, the local biologist can provide advice on where to prioritize treatments and to modify timing/treatment methods if necessary to reduce impacts. Consequently the potential for adverse effects would be reduced. With implementation of this pdf and considering the small amount of habitat proposed for treatment, the likelihood that treatments would directly affect the silver-bordered fritillary is reduced.

The silver-bordered fritillary is dependent upon maintenance of wet meadow habitat and invasive plants can reduce the abundance and/or cover of larval food plants as well as nectar plants (violet). As a result, and because treatment would help to contain or control invasive plants, all alternatives would help to promote native plant communities and help sustain silver-bordered fritillary habitat over the long term.

Herbicides - Information on the effects of herbicides on butterflies is limited, but some field studies have attempted to determine the effects of herbicide use on butterfly populations. Bramble et al (1997) investigated butterfly diversity and abundance on electric transmission right-of-ways (ROW) treated with herbicides versus those treated with only mechanical methods. Herbicides used in the ROW treatments included a mixture of picloram and triclopyr, triclopyr and metsulfuron methyl, glyphosate and fosamine, triclopyr and imazapyr and glyphosate alone. They evaluated effects on 15 species and found no significant difference in diversity or abundance of butterflies between herbicide and non-herbicide units.

Sucoff et al. (2001) studied effects of herbicides on host plants, eggs and larvae of the Karner blue butterfly (*Lycaeides Melissa*) from treatments with glyphosate, glyphosate-sulfometuron methyl mix and glyphosate-triclopyr mix. Treatment did not inhibit flowering of the larval food plant, whereas glyphosate, triclopyr, and glyphosate-sulfometuron methyl mix treatments did not significantly reduce egg hatching, pupation of larvae, and emergence of adults, pupae size, or rate of development of percent of eggs that produced adults. While glyphosate-triclopyr mix did significantly reduce egg hatching, with implementation of pdfs (F2) restricting application rates of these herbicides, no toxic exposures are anticipated. Currently, triclopyr is not among the first-choice herbicides in any alternative.

Although data is limited, existing information (SERA 2007, Bramble 1997, USDA Forest Service 2005a) and extent of treatment (less than1 percent of the suitable habitat affected) indicates that preferred herbicides under alternatives B and C (aminopyralid, chlorsulfuron and metsulfuron methyl) are not likely to result in toxic levels to this species. Implementation of the following pdfs would greatly reduce the likelihood that adverse effects from herbicide exposure would occur, or that host plants would be affected by treatment:

- pdf J6-a – Buffers for vascular plant species of concern would be implemented on sites that contain host/nectar plants, reducing the likelihood of herbicide exposure to these species.
- pdf J6-b Treatment type and timing in occupied habitat would be coordinated with a biologist, so that the type or timing of treatment can be modified if necessary to reduce potential impacts. Also use of ester formulations of herbicide and NPE-based surfactants in known silver-bordered fritillary habitat would be prohibited.

- pdf F2 – The least amount of any given herbicide needed to effectively meet site objectives would be used, NPE-based surfactants cannot be applied at levels above 0.5 lbs./ac and broadcast application of glyphosate or picloram, will not exceed typical application rates.

With implementation of these design features and considering the small amount of habitat proposed for first-year treatment, it is unlikely that adverse effects from herbicide exposure would occur to adults, pupae or eggs under any alternative.

Cumulative Effects

This species occupies non-forested riparian/wetland habitat, so other than continued grazing and recreational use, few of the anticipated ongoing and future activities would occur within suitable habitat. Since they are known to occupy adjacent private land, it is possible that adults could be exposed to herbicides on all ownerships. The toxicity of proposed herbicides to invertebrates is low and pdfs further reduce the likelihood of herbicide exposure. As a result and considering the small amount of habitat proposed for treatment within any watershed, it is unlikely that treatment on National Forest System land would result in toxic levels of herbicides to adult butterflies or measurably contribute to any other past, on-going or future activity and result in significant effects to this species.

Summary and Determination

Silver bordered fritillary is not documented within the project area, although it is documented adjacent to the Malheur National Forest so use on the Forest is likely. Invasive plant treatments in any of the action alternatives “may impact individuals or habitat” (MIIH), but are not likely to lead to a trend toward federal listing” for the silver-bordered fritillary.

- Within occupied habitat, project design features are in place that would protect host/nectar plants, and minimize the likelihood of adverse effects from treatment.
- Based on available data and with implementation of project design features, proposed herbicides would not result in a dose of concern for terrestrial invertebrates.
- Approximately 35 acres of preferred habitat are proposed for treatment and it is unlikely an occupied site would be affected.
- Proposed treatments would reduce invasive plants and help to maintain native riparian grassland habitat.

Management Indicator Species

Table 65. Treatment effects determinations for management indicator species (MIS)

Species	Treatment Effects Determination
Rocky Mountain Elk	Treatment effects limited to short term disturbance. Herbicide exposure unlikely. Grassland habitat and local elk populations maintained. Implementation of any of the action alternatives would not contribute to a negative trend in viability for this species within the Malheur National Forest.
Pileated woodpecker	No treatment or herbicide effects to nesting birds. Disturbance to foraging birds possible. No herbicide exposure anticipated. Suitable habitat and local populations maintained. Implementation of any of the action alternatives would not contribute to a negative trend in viability for this species within the Malheur National Forest.
Pine (American) marten	Not likely to occur in treatment areas. Suitable habitat and local populations maintained. Implementation of any of the action alternatives would not contribute to a negative trend in viability for this species within the Malheur National Forest.

Species	Treatment Effects Determination
Three-toed woodpecker	No treatment effects to nesting birds. Disturbance to foraging birds possible. No herbicide exposure anticipated. Suitable habitat and local populations maintained. Implementation of any of the action alternatives would not contribute to a negative trend in viability for this species within the Malheur National Forest.
MIS cavity excavators	No treatment effects to nesting birds. Disturbance to foraging birds possible. No herbicide exposure anticipated. Suitable habitat and local populations maintained. Implementation of any of the action alternatives would not contribute to a negative trend in viability for this species within the Malheur National Forest.

Rocky Mountain Elk

Approximately 2,124 acres of elk summer range are known to contain invasive plants. Of this, approximately 1,860 acres (88 percent) are adjacent to roads. While there are no invasive plant treatments proposed within elk calving areas, approximately 517 acres of the elk winter range is currently known to contain invasive plant species. Treatment would occur across 100 watersheds (HUC 6) ranging in size from 10,000 to 40,000 acres. While six watersheds have 100 acres or more proposed for treatment (120 to 170 acres), one percent or less of all watersheds would be treated.

Direct and Indirect Effects

Treatment - Elk are sensitive to human disturbance, so proposed treatments can adversely affect big game due to disturbance and increased human access. About 88 percent of proposed treatments are close to open roads, which are less likely to be used as habitat (Thomas 1979). Also treatment within any drainage would be short term (a few days) and unaffected habitat is widely available. As a result, disturbance would likely result in animals avoiding areas during treatment. Also with implementation of the following design features, the likelihood of disturbance during sensitive or key periods would be reduced:

- pdf J12-a –To reduce stress during the winter, restrict off-highway vehicle use within MA 41 (big game winter range) between December 1st and April 1st.
- pdf J12-b – To prevent harassment in designated calving areas, restrict off-highway vehicles and other motorized traffic use to designated roads and trails from May 1st to June 31st.

Invasive plants can reduce the ability of an area to support elk and result in a loss of forage quality and quantity for big game (Rice et al. 1997, Bedunah and Carpenter 1989, Trammel and Butler 1996). As a result treatment of invasive plants would beneficially affect elk (and deer) by preserving native forage species and maintaining the long-term suitability of foraging habitat.

Herbicides - Mammals such as elk that eat vegetation (primarily grass) that has been sprayed with herbicide have relatively greater risk for adverse effects because herbicide residue is higher on grass than it is on other herbaceous vegetation or seeds (Kenaga 1973, Fletcher et al. 1994, Pfleeger et al. 1996).

At the highest application rates, glyphosate and picloram exceeded levels of concern at acute exposures and NPE-based surfactants exceeded acute and chronic levels of concern at the typical and highest application rates. A chronic exposure of concern resulted from sethoxydim applied at the highest rate and triclopyr at the typical and highest rates. The likelihood of exposure is reduced due to implementation of Malheur National Forest LRMP standards which restrict use of triclopyr to selective techniques/spot treatment and with implementation of pdf F2 that prevents glyphosate and picloram from being broadcast sprayed above typical application rates and restricts NPE-based surfactants from being applied above 0.5 lbs. active ingredient per acre. The likelihood of exposure is further reduced when considering that elk forage over large areas and are not likely to consume an entire days diet of contaminated vegetation (acute exposure) from forage exclusively on contaminated vegetation for 90 days (chronic exposure). As a

result and considering that 88 percent of the proposed treatments occur close to open roads which are less likely to be used by elk (Thomas 1979) it is unlikely that elk would be adversely affected by herbicide exposure

Cumulative Effects

Anticipated cumulative effects are discussed under the alternative evaluation above and ongoing and future activities would be implemented on 60 watersheds forestwide. Proposed timber harvest would reduce elk cover, so Forest LRMP standards related to habitat effectiveness and hiding and thermal cover would be adhered to. Also much of the harvest, as well as prescribed fire and plantation thinning would improve elk forage on summer, winter and transition ranges. As a result and considering that proposed treatments would help to maintain native forage over the long term, elk habitat would be maintained in all affected watersheds. While proposed treatments could increase disturbance to elk on summer range, effects would be short term. As a result and considering that 88 percent of proposed treatments occur close to roads where elk are less likely to occur, there are no long-term disturbance related effects anticipated.

Because elk utilize all ownerships, anticipated cumulative effects include possible exposure to herbicides on state, private and BLM land. For adverse effects from herbicide exposure to occur, the two exposures would have to occur at approximately the same time. This is unlikely since the herbicides proposed are rapidly eliminated and do not significantly bio-accumulate (USDA Forest Service 2005a). The risk of herbicide exposure over a level of concern would be avoided by implementation of pdfs that restrict herbicide application rates, provide herbicide-use buffers along streams, waterbodies and riparian areas, and minimize drift from broadcast application. The risk of exposure is further reduced when you consider that 1 percent or less of any watershed would be affected by treatment and that most treatment occurs in less preferred habitat adjacent to open roads. Collectively for these reasons, none of the alternatives would measurably contribute to any other past, current or foreseeable activity related to herbicide exposure and there are no significant cumulative effects to elk anticipated.

Summary and Determination

There are no adverse effects from herbicide exposure anticipated. Proposed treatments may result in short-term disturbance during treatment; ultimately treatment would reduce invasive plants and help to maintain native big game range. As a result, local populations of elk and hunting opportunities would be maintained. Implementation of the action alternatives would not contribute to a negative trend in viability for elk on the Malheur National Forest.

Pine (American) Marten

Direct, Indirect and Cumulative Effects

Marten prefer closed-canopy forest away from open roads (where 88 percent of proposed treatment sites are); therefore, it is unlikely they would be found in treatment sites. Also invasive plant treatments would not alter forested habitat. As a result, and considering no herbicide or NPE-based surfactant exceeded a level of concern for carnivores eating contaminated small mammals, proposed treatments would not adversely affect marten or alter their habitat under any alternative.

Summary and Determination

There are no direct, indirect or cumulative effects to marten anticipated and implementation of the action alternatives would not contribute to a negative trend in viability for this species on the Malheur National Forest.

Cavity Nesters and Species Dependent on Downed Wood

Because they occupy similar habitats and have similar threats, cavity nesting species or species that require standing dead (snags) and downed woody debris are discussed collectively.[21] These species include; pileated woodpecker, northern three-toed woodpecker, northern flicker, red-naped sapsucker, red-breasted sapsucker, Williamson's sapsucker, downy woodpecker, hairy woodpecker, and black-backed woodpecker.

Direct and Indirect Effects

Treatment **-** No snags or trees would be removed, therefore nest habitat would be unaffected. Disturbance to foraging birds would occur, particularly to species such as the pileated woodpecker or northern flicker that forage on the ground or in more open canopy conditions. Sites are small and scattered, so unaffected habitat is available and effects would be limited to short-term disturbance during treatment. Cavity nesting species are not at risk from herbicides and existing habitat would be unchanged.

Herbicides **-** Species that forage and nest in trees are not likely to be exposed to herbicides because no trees would be treated and no aerial application is proposed. Species such as the pileated woodpecker and northern flicker that feed on the ground or in low shrubs may consume contaminated insects.

Effects of herbicide exposure are the same as those described under the Lewis' and white-headed woodpecker. As described, with implementation of pdfs the likelihood of herbicide exposure is reduced. The likelihood of exposure is further reduced when you consider that birds forage over large areas and that many of the insects utilized occur within dead wood, under bark or are taken from areas not exposed to herbicides. As a result birds are not likely to consume exclusively contaminated insects and there are no adverse effects from herbicide exposure anticipated under any alternative.

Cumulative Effects - These species could be affected by any activity that reduces snags or downed wood, or modify the overstory, particularly timber harvest and prescribed burning. Timber harvest and invasive plant treatments would occur within 39 watersheds, which include approximately 1,100 acres of treatment. While timber harvest would reduce habitat for some species, habitat for others would be improved. Also with implementation of Forest standards, a component of snags and downed wood would be retained on all sites. As a result, and considering the proposed treatments would not modify suitable habitat and that there are no adverse effects from herbicide exposure anticipated, none of the alternatives would measurably contribute to any other past, current or foreseeable activity and there are no significant cumulative effects to snag or downed wood dependent species anticipated.

Summary and Determination

Suitable habitat for MIS and sensitive cavity nesting species overlap with mapped infestations proposed for treatment. It is unlikely nesting birds would be affected and any disturbance to foraging birds would be short-term (usually one day or less). Suitable nesting habitat would be unaffected by treatment and implementation of the action alternatives would not contribute to a negative trend in viability for cavity nesting or downed wood dependent species on the Malheur National Forest.

[21] Findings and determinations for the Lewis and white-headed woodpeckers were discussed previously in the Forest Service Sensitive Species section.

Effects to Featured Species

California Bighorn Sheep

Direct and Indirect Effects

Treatment - Less than 14 acres of bighorn sheep habitat is proposed for treatment and the likelihood of disturbance is remote. Should future treatments be proposed within occupied habitat, treatment modifications/timing would be made if necessary during preparation of annual prescriptions to ensure sheep are not disturbed and all alternatives are in compliance with LRMP standard 55. Due to the small amount of habitat known to contain invasive plants, suitable habitat would be unchanged.

Herbicides - Effects from herbicide exposure would be similar to those described under elk, and with implementation of pdfs the likelihood of exposure is reduced. The likelihood of exposure is further reduced when you consider the small amount of habitat proposed for first-year treatment and that sheep are not likely to consume exclusively contaminated vegetation. As a result, there are no adverse effects from herbicide exposure anticipated under any alternative.

Cumulative Effects

Other than grazing and recreation, there are few on-going/future activities within suitable habitat anticipated. As a result, and considering the small amount of habitat proposed for treatment, none of the alternatives would measurably contribute to any other past, current or foreseeable activity and there are no significant cumulative effects anticipated.

Summary and Determination

Due to the small amount of habitat proposed for treatment and considering that are no adverse effects from herbicide exposure, local populations of bighorn sheep and there habitat would be maintained under all alternatives.

Northern Goshawk

Direct and Indirect Effects

Treatment - There are 567 acres of goshawk nesting/foraging habitat and 18 acres within post fledgling habitat proposed for treatment. The northern goshawk prefers closed-canopy mature forest for nesting and foraging, therefore, its habitat is not at risk from invasive plants. As a result, and with implementation of pdf J11-a that restricts activity within 0.50 mile of known nest sites, there are no effects to nesting goshawks anticipated. There would be no changes to existing habitat from proposed treatment.

Herbicides - At the typical application rate, no herbicide or surfactant exceeded the toxicity index for an acute or chronic exposure, whereas NPE exceeded the NOAEL and sethoxydim equaled the NOAEL at the highest application rate. Project design feature F2 restricts broadcast application of sethoxydim to the typical application rate and prevents NPE from being applied above 0.5 lbs. active ingredient per acres. As a result and considering that goshawk forage over large areas and are unlikely to feed exclusively on contaminated prey, there are no adverse effects from herbicide exposure anticipated.

Cumulative Effects

While ongoing and future activities would modify goshawk nesting and foraging habitat, Forest Plan standards would protect nest sites and PFA areas. As a result and considering proposed actions would not modify habitat or result in adverse effects from herbicide exposure, none of the alternatives would measurably contribute to any other past, current or foreseeable activity and there are no significant cumulative effects anticipated.

Summary and Determination

Suitable goshawk habitat would be maintained and any effects from treatment would be minor and short term Local populations of northern goshawk and their habitat would be maintained under all alternatives.

Blue Grouse

Direct and Indirect Effects

Treatment - Blue grouse winter at upper elevations, and winter habitat is largely unaffected by invasive plants or treatment. They breed within openings at lower elevations and treatments within open canopy forest and grassland/shrub habitats near forest could disturb grouse, or result in mortality to nests or chicks. There are approximately 125 acres proposed for treatment in mountain meadow, step shrublands or riparian/shrub habitats. Due to the small size of treatment sites and widespread availability of unaffected habitat the likelihood of adverse impacts is low. This species is not at risk from invasive plants and suitable winter and summer habitat would be unchanged.

Herbicides - Adult blue grouse forage primarily on shrubs and herbaceous vegetation during the summer months and chicks consume large quantities of insects, thus, risk of effects from herbicide exposure was evaluated using the insectivorous bird scenario, as well as a large bird consuming vegetation.

For adult birds and chicks at typical application rates, only triclopyr (if broadcast sprayed) and NPE surfactants exceeded the acute toxicity thresholds, whereas glyphosate exceeded a dose of concern at the highest rate for small birds consuming insects. The Malheur National Forest LRMP restricts application to triclopyr to selective techniques/spot treatment and with implementation of pdf F2, NPE based surfactants would only be applied at a rate of 0.5 lbs. active ingredient per acre and glyphosate would not be broadcast sprayed above typical application rate. As a result, it is unlikely that adult birds or chicks would receive an acute exposure of concern.

Chronic exposures were also evaluated and at the typical application rate for large birds consuming vegetation triclopyr exceeded a dose of concern, whereas sethoxydim, sulfometuron methyl, glyphosate and triclopyr exceeded the toxicity threshold at the highest application rate. With implementation of pdf F2 that restricts broadcast application of clopyralid, glyphosate, picloram, sethoxydim and sulfometuron methyl to typical application rates and the Malheur National Forest LRMP Plan standard that prevents broadcast application of triclopyr, the likelihood of exposure is reduced. Triclopyr is not a first-choice herbicide in any alternative. As a result and considering the small size and scattered nature of treatments sites, birds would not be expected to forage exclusively on contaminated insects or plants and be exposed to herbicides at levels of concern.

Cumulative Effects

Approximately 125 acres of summer habitat could be affected by treatment. Future timber harvest is unlikely to adversely affect forested riparian and upland shrub habitats due to changes in overstory and understory vegetation. While prescribed burning could result in short-term impacts to understory vegetation, treatment would promote the maintenance of shrub diversity over the long-term. Similarly, proposed treatments would help to reduce invasive plants and maintain native shrub, grass and forb diversity. None of the alternatives would measurably contribute to any other past, current or foreseeable activity and result in significant cumulative effects.

Summary and Determination

Proposed activities would not modify suitable habitat and no long-term effects from treatment are anticipated. As a result, suitable habitat and local populations of blue grouse would be maintained.

Osprey

Direct and Indirect Effects

Treatment - There are no known osprey nests on the Forest and considering pdf J11-a protects osprey nests should one become established, thus there would be no effects to nesting birds or reproduction. Osprey forage and nest over standing water, so neither birds or their habitat would not be affected by treatment.

Herbicides - While osprey would not be directly sprayed, they could consume fish exposed to herbicides. Doses were estimated assuming that birds ate nothing but fish contaminated by a spill of 200 gallons into a 0.25 acre pond, over a lifetime. All expected doses to fish-eating birds for all herbicides and NPE are well below any known no-observable-adverse-effect-level (NOAEL) and the weight of evidence suggests that adverse effects to this species group from NPE or the herbicides included in the action alternatives are not plausible.

Cumulative Effects

Ongoing and future activities on NFS lands are not expected to adversely affect osprey. While birds could be exposed to herbicides on lands of other ownerships, for adverse effects from herbicide exposure to occur, the two exposures would have to occur at approximately the same time. This is unlikely since the herbicides proposed are rapidly eliminated and do not significantly bio-accumulate (USDA Forest Service 2005a). Also with implementation of pdfs that limit the application rate and method for higher-risk herbicides, provide herbicide buffers along streams, waterbodies and riparian areas, and minimize drift from broadcast application, the risk of herbicide exposure is further reduced. As a result, none of the alternatives would measurably contribute to any other past, current or foreseeable activity related to herbicide exposure and there are no significant cumulative effects to osprey anticipated.

Summary and Determination

Osprey and their habitat would be unaffected by invasive plants or proposed treatments and local populations would be maintained.

Pronghorn Antelope

Direct and Indirect Effects

Treatment - Approximately 122 acres of invasive plants would be treated within sagebrush habitat adjacent to private lands and suitable pronghorn habitat. This would occur across 25 watersheds with 70 (alternative B) to 83 (alternative D) percent of the herbicide application occurring as spot treatment. Under alternative C, 75 percent of the treatments would be with manual/mechanical methods.

Although pronghorn occupy more open habitat, the potential effects of invasive plant treatment to pronghorns would be similar to those discussed under the rocky mountain elk. Both species graze herbaceous plants, graze over large areas and are sensitive to human disturbance. Direct effects would be limited to minor short-term disturbance during treatment and all alternatives are in compliance with LRMP standard 52. Because treatments would contain or control invasive plants, pronghorn habitat would be maintained under all action alternatives.

Herbicides - Effects of herbicide use would be the same as those described for elk. While exposures of concern are possible, with implementation of the Malheur National Forest LRMP standard that restricts use of triclopyr to selective techniques and pdf F2 that prevents glyphosate and picloram from being broadcast sprayed above typical application rates and restricts NPE based surfactants from being applied above 0.5 lbs. active ingredient per acre, the likelihood of exposure is reduced. As a result and

considering that pronghorn forage over large areas are not likely to consume exclusively contaminated vegetation, it is unlikely that antelope would be adversely affected by herbicide exposure.

Cumulative Effects

Although future grazing would continue to affect pronghorn, existing use is not expected to change and with compliance of LRMP standards, suitable pronghorn habitat would likely be maintained. While animals could be exposed to herbicides on lands of other ownerships, none of the alternatives would measurably contribute to past, current or foreseeable activity and result in significant cumulative effects.

Summary and Determination

While proposed treatments may result in short-term disturbance during treatment, habitat would be maintained or improved and there are no adverse effects from herbicide exposure anticipated. As a result, local populations of pronghorn would be maintained.

Effects to Birds of Conservation Concern

This section evaluates effects to landbirds, birds of conservation concern and game birds below desired condition identified in section 3.72. Table 66 displays species not evaluated previously and groups species into similar feeding strategies for analysis.

Table 66. Exposure groups, habitat and species included in each group

Animal/Diet Group	Habitat	Species
Predatory Birds (small mammal)	Grassland, Shrub-steppe, Dry Forest, Juniper-steppe, Rimrock-cliff	Swainson's hawk, Prairie falcon, Burrowing Owl, Ferruginous hawk, Flammulated Owl
Insectivorous Birds	Dry Forest, Mesic Mixed Conifer, Riparian Woodland and Shrub, Shrub-steppe, Alpine, Sagebrush, Juniper Woodland, open water/wetland.	Chipping sparrow, Vaux's swift, Townsend's warbler, varied thrush, MacGillivay's warbler, red-eyed vireo, veery, willow flycatcher, hermit thrush, vesper sparrow, gray-crowned rosy finch, loggerhead shrike, lark sparrow, black-throated sparrow, Bullock's oriole, yellow warbler, yellow-breasted chat, yellow-billed cuckoo, Lazuli bunting, gray flycatcher, Virginia' warbler, Yellow-billed cuckoo, Olive-sided flycatcher, sage sparrow, Brewer' sparrow, sage thrasher, sage sparrow, Black swift, Calliope hummingbird, Williamson's sapsucker, McCown's longspur, Black rosy finch, Cassins finch, Long billed curlew.
Herbivorous bird	Shrub-steppe	Sharp-tail Grouse,
Waterfowl	Wetlands, riparian areas and open water habitats	Canvasback, ring-necked duck, wood duck, mallard, northern pintail, redhead, lesser scaup, American

Animal/Diet Group	Habitat	Species
		wigeon

Predatory Birds

Direct and Indirect and Cumulative Effects

With implementation of pdf J11-a, raptor nests would be protected and there are no adverse effects to nesting birds or reproduction anticipated under any alternative. While foraging birds could be affected, the short-term (one day or less), low magnitude, and limited extent (usually 1 acre or less scattered over larger areas) of disturbance that will occur with invasive plant treatments would not adversely affect species in this group.

First-choice herbicides under alternatives B and C do not pose a risk these species. Also picloram and glyphosate (alternative D) did not exceed the toxicity index at typical or highest application rates. Only NPE-based surfactants exceeded the reported NOAEL (no observable adverse effect level) at the highest application rate. As a result, and with implementation of F2 that restricts the use of NPE-based surfactants to 0.5 lbs. of active ingredient per acre, there are no adverse effects from herbicide exposure under any alternative.

Cumulative effects would be similar to those described under northern goshawk

Insectivorous Birds

Direct, Indirect and Cumulative Effects

Effects to these species will vary and there would be little effect to forested species such as the Townsend's warbler that utilize closed-canopy forest and nest off the ground. However for species such as the veery or Brewer's sparrow which nests on or near the ground or in shrubs, effects include possible mortality associated with trampling of the nest. Due to the small size of treatment sites and widespread availability of unaffected habitat, the likelihood of mortality is low and direct effects would include short-term disturbance of some species during treatment.

Risk of effects from herbicide exposure was evaluated using the insectivorous bird scenario and effects would be similar to those described for the grasshopper sparrow. While use of some herbicides and NPE could result in an adverse effect, implementation of the Malheur National Forest Plan standard that restricts use of triclopyr to selective methods only, and pdf F2 that restricts broadcast application of clopyralid, glyphosate, picloram, sethoxydim and sulfometuron methyl to typical application rates, the likelihood of herbicide exposure is minimal. Exposure is further reduced when you consider the small and scattered nature of the treatment sites and availability of unaffected habitat, which would reduce the likelihood that birds would forage exclusively on contaminated insects. As a result, there are no adverse effects from herbicide exposure anticipated under any alternative.

Cumulative effects would be similar to those described under grasshopper sparrow.

Herbivorous Birds

Direct, Indirect and Cumulative Effects

The Columbia sharptail grouse has not been documented on the Forest and there are no direct effects from treatment anticipated. Should future use within treatment sites be documented, necessary treatment modification would be made as part of the annual review and monitoring process and it is unlikely that the Columbia sharp-tailed grouse would be directly affected by treatment. While all alternatives would

control invasive plants within sagebrush communities, because it has the widest range of treatment options, alternative B would be the most effective, particularly with larger infestations.

Should documentation of the sharp-tailed grouse occur in the future, effects would be similar to those described under sage grouse and there are no adverse effects from herbicide exposure anticipated under any alternative.

Cumulative effects would be similar to those described under sage grouse and upland sandpiper

Waterfowl

Direct, Indirect and Cumulative Effects

While all alternatives would help to contain and control invasive plants, treatments proposed under alternatives C and D are less effective (see chapter 3.1.4); therefore, treatment effectiveness of invasive plants within wetland and riparian habitat would best be achieved under alternative B. Risk of disturbance is also greater under alternatives C and D because more repeated treatments may be necessary increasing use of spot herbicide application and manual/mechanical treatments.

Disturbance to waterfowl could occur under any alternative from herbicide or non-herbicide methods. With implementation of herbicide-use buffers, retention of untreated areas near water (H7-H9) and considering the small and scattered nature of treatment sites within suitable habitat, it is unlikely nests would be affected and the likelihood of direct effects is low.

The diet of these species varies; species such as the redhead eat primarily plant material, and the canvasback, ring-necked duck, mallard, pintail, lesser scaup and American widgeon eat a combination of plants and insects. Also some species such as the wood duck and pintail eat vegetation or insects away from water within woodlands or open habitat. As a result, effects of herbicide exposure to waterfowl were evaluated using the insectivorous and herbaceous eating bird scenarios, as well as by evaluating the likelihood aquatic organisms would be affected.

Effects to aquatic invertebrates and plants were evaluated under the fisheries analysis and as described, concentrations of herbicides potentially delivered to any water body on the Malheur National Forest would remain well below levels capable of measurably affecting aquatic organisms, including: fish, amphibians, or aquatic invertebrates. Herbicide exposures to birds consuming insects or plant material would be similar to those described above (i.e. insectivorous and herbivorous birds) and the following pdfs reduce the likelihood that waterfowl would be exposed to toxic levels of herbicide.

- The Malheur National Forest Plan restricts use of triclopyr to selective and spot techniques only.
- pdf F2 restricts broadcast application of NPE-based surfactant to 0.5 lbs. of active ingredient per acre and restricts broadcast application of clopyralid, glyphosate, picloram, sethoxydim and sulfometuron methyl to typical application rates.
- Project design features (H1, H2, H5, and H8-H10) would greatly reduce the likelihood for herbicides to be delivered to wetlands, lakes, ponds, wells, springs or stock tanks.
- Restrictions on extent of treatment in a given site (H4, H5 and H7) ensure that herbicides would not be delivered in amounts greater than the SERA risk assessment scenarios and that unsprayed areas around wetlands, lakes and ponds would be retained.

The likelihood of exposure to herbicide would be further reduced because of herbicide-use buffers and the application of pdfs around streams, wetlands, lakes, ponds, intermittent and ephemeral streams (table 10). Collectively, these measures in combination with the use of low risk first year/first choice herbicides will greatly reduce the likelihood that waterfowl would be exposed to toxic levels of herbicide. As a result,

and considering that birds would unlikely forage exclusively on contaminated prey/plant material, there are no adverse effects from herbicide exposure anticipated.

Cumulative effects would be similar to those discussed under bufflehead and osprey.

Migratory Bird Summary

Migratory birds and their habitats including species with viability concern (TES), regional landbirds, birds of conservation concern and gamebirds below the desired condition were evaluated. While short-term effects to some migratory bird species may occur, the likelihood of mortality is low. Mitigation measures have been included to reduce effects and there are no long-term adverse effects from treatment anticipated, nor is it likely that migratory birds would be exposed to toxic levels of herbicide. There would be no reduction in native vegetation, and all alternatives would help to reduce invasive plants and maintain migratory bird habitat. All action alternatives are consistent with the Migratory Bird Treaty Act and Executive Order 13186.

3.8 Range

3.8.1 Introduction

This section discusses the effects of alternatives on range resources, with emphasis on the herbicide treatments proposed. The analysis addresses effects of the alternatives on livestock and the need for specific grazing administration during and after herbicide use.

Regulatory Framework and Compliance

Several of the goals, objectives, standards and guidelines from the R6 2005 ROD are about grazing and range management. This invasive plant treatment project complies with the treatment and restoration standards and assumes compliance with the prevention standards. Prevention of invasive plants on grazing allotments is part of grazing projects and compliance with prevention standards is assumed for this analysis.

Table 67. Standards from the R6 2005 ROD and the relationship to Range Management

R6 2005 ROD Standard	Relationship to Range Management	Implementation
Prevention Standard 1	Prevention of invasive plant introduction, establishment and spread will be addressed in grazing allotment and vegetation management plans.	Direction from Forest LRMP, the 2001 Guide to Noxious Weed Prevention Practices, and the 2005 ROD addressed in all projects.
Prevention Standard 2	Actions conducted or authorized by written permit by the Forest Service that will operate outside the limits of the road prism . . . require the cleaning of all heavy equipment … prior to entering National Forest System Lands.	Private lands associated with permittees are periodically surveyed to determine the presence of invasive species and the need for washing of vehicles such as water trucks and ranch vehicles before entry onto National Forest System Lands. Water trucks are generally restricted to roads or “haul routes” that like roads are compacted and disturbed. Destinations are water set areas used year after year.
Prevention Standard 3	Use weed-free straw and/or mulch for all projects, conducted or authorized by the Forest Service, on National Forest System lands. If state certified straw and/or mulch is not available, individual Forests should require	Where straw and/or mulch may be used as bedding for livestock operations and/or restoration projects.

R6 2005 ROD Standard	Relationship to Range Management	Implementation
	sources certified to be weed-free using the North American Weed Free Forage Program standards (see Appendix O) or a similar certification process.	
Prevention Standard 4	Use only pelletized or certified weed free feed on all National Forest System Lands. If State certified weed free feed is not available, individual Forests should require feed certified to be weed free using the North American Weed Free Forage Program standards or a similar certification processes Choose weed-free project staging areas, livestock and packhorse corrals, and trailheads.	Would phase in the use of weed free feed by permittees on all allotments over time including hay. Hay and other feeds are occasionally used to gather or attract livestock, generally in preparation for a move. Would have permittees avoid those areas that become infested with invasive plants for livestock operations such as gather, herding, the staging of vehicles and livestock watering. The bigger concern would be where the permittee transports horses onto the allotment and brings hay products in with the trailer or if the permittee stays overnight and feeds horses at a line camp.
Prevention Standard 5	Retain native vegetation consistent with site capability and integrated resource management objectives to suppress invasive plants and prevent their establishment and growth.	Compliments CDO. Land and resource management plans standards and guidelines that call for maintaining or improving vegetation conditions on allotments.
Prevention Standard 6	Use available administrative mechanisms to incorporate invasive plant prevention practices into rangeland management. Examples of administrative mechanisms include, but are not limited to, revising permits and grazing allotment plans, providing annual operating instructions, and adaptive management. Plan and implement practices in cooperation with the grazing permit holder.	Accomplished long term through environmental analysis projects that lead to new allotment management plans and grazing permits. Cooperate with grazing permittee on an annual basis to incorporate invasive species prevention practices in annual operation plans and use adaptive management to recognize changing science and ecosystem conditions.
Treatment Restoration Standard 11	Prioritize infestations of invasive plants for treatment at the landscape, watershed or larger multiple forest/multiple owner scale.	Provides an opportunity to focus on local problem areas and establish “community” based solutions that might include, but is not limited to, multiple ranches, state and/or BLM lands.
Treatment Restoration Standard 23	Prior to implementation of herbicide treatment projects, National Forest system staff will ensure timely public notification. Treatment areas will be posted to inform the public and forest workers of herbicide application dates and herbicides used. If requested, individuals will be notified in advance of spray dates.	Permittees will be notified upon request of specific treatments dates. Permittees will be notified of invasive plant treatment areas and the potential for treatment by herbicides as needed on an annual basis. The most appropriate method would be during annual operating meetings.

3.8.2 Affected Environment

Currently, more than 99 percent of the Malheur National Forest is incorporated into cattle grazing range allotments (1,695,228 acres, based on GIS data for the Malheur National Forest). The Malheur National Forest administers 106 grazing allotments, of which 98 are active and 8 are vacant. There are currently invasive plant infestations mapped on 86 of these allotments (81%) including on five of the vacant allotments. Infested sites range in size from one plant to numerous plants scattered over large acreages. Over 90 percent of inventoried sites are less than 1 acre in size and an additional one percent of the sites are less than 5 acres in size. See table 68 below showing the extent of mapped invasive species within each allotment.

Certain invasive plants are known to be toxic to various classes of permitted livestock. Canada thistle has the potential to concentrate nitrates and cause nitrate poisoning in ruminants. Russian knapweed and yellow starthistle both produce a unique poisoning of horses that is generally fatal. Leafy spurge can cause excessive salivation and diarrhea in cattle; however it does not appear to affect sheep and goats (USDA Forest Service 2012c). Houndstongue and tansy may cause liver problems in livestock, particularly cattle and horses.

Table 68. Invasive plant species information by allotment

Allotment Name	Status Active (A) Vacant (V)	District	Forest land allotment acres	Number of invasive species sites mapped	Number of target invasive species mapped in allotment	Invasive plant species acres*
Aldrich	A	BM	20572	1	1	8
Alkali	A	EC	26753	106	5	71
Allison	A	EC	21156	11	4	1.5
Antelope (Silvies)	A	BM	29381	7	5	1
Antelope (Upper Malheur)	A	PC	5512	2	1	0.14
Austin	V	BM	672	4	3	9
Balance Creek	A	BM	365	0	0	0
Bear Creek	A	BM	1532	9	3	18
Beech Creek	A	BM	3756	10	3	14
Biggs On/Off	A	BM	166	0	0	0
Big Sagehen	A	EC	21612	56	8	8
Blue Creek	A	EC	16738	39	7	6
Blue Mountain	V	BM	22709	196	8	243
Bluebucket	A	PC	23436	11	3	5
Bridge Creek	A		8354	13	3	1.5
Buck Mountain	A	EC	41479	2	2	0.14
Calamity	A	BM	23204	66	6	25
Camp Creek (Silvies)	A	BM	14958	10	4	13
Central Malheur	A	EC	11377	22	3	5
County Road	A	BM	0	0	0	0
Crooked Creek	A	BM	5076	10	3	1
Dark Canyon	A	BM	31808	40	9	5.29
Deadhorse	A	BM	15527	5	4	0.52

Allotment Name	Status Active (A) Vacant (V)	District	Forest land allotment acres	Number of invasive species sites mapped	Number of target invasive species mapped in allotment	Invasive plant species acres*
Deardorff	A	PC	11927	24	4	11
Deer Creek	A	BM	2998	2	2	0.21
Devine	A	EC	25390	146	6	26
Dixie	A	BM	26875	14	5	2
Dollar Basin	A	PC	16396	5	3	5
Donaldson	A	BM	8008	14	5	10
Donnelly	A	EC	56083	30	4	24
Emigrant Creek	V	EC	1609	2	1	0.20
Fawn Spring	A	BM	6615	18	6	4
Ferg	A	BM	478	1	1	0.10
Fields Peak	A	BM	30735	47	7	6
Flag Prairie	A	PC	28775	33	6	18
Flagtail	A	BM	14978	19	6	32
Fox	A	BM	26589	63	7	30
Frenchy	A	BM	525	0	0	0
Green Butte	A	EC	45265	9	4	2
Hamilton	A	BM	3410	7	4	0.71
Hanscomb	A	BM	9105	4	3	0.74
Herberger	V	BM	553	0	0	0
Highway	A	BM	905	0	0	0
Hot Springs	A	PC	4693	0	0	0
House Creek	A	EC	3252	15	3	1
Hughet Valley	A	EC	1877	0	0	0
Hunter Cabin	A	BM	15892	0	0	0
Indian Creek	A	PC	2593	1	1	0.10
Indian Ridge	A	BM	3440	20	8	2.50
Izee	A	EC	22219	22	5	15
Jack Creek	A	BM	10358	55	8	17
Joaquin	A	BM	38	0	0	0
Justice	A	BM	825	0	0	0
Keeney Meadows	A	BM	450	1	1	0.08
Koehler	A	BM	1002	0	0	0
King	A	BM	2237	0	0	0
Lake Creek	V	PC	10195	15	5	7
Lewis Creek	A	BM	2604	0	0	0
Little Mowich	A	EC	317	0	0	0
Logan Valley	A	PC	3780	6	3	0.61
Lonesome	A	EC	32085	30	4	32
Long Creek	A	BM	50241	83	10	57

Allotment Name	Status Active (A) Vacant (V)	District	Forest land allotment acres	Number of invasive species sites mapped	Number of target invasive species mapped in allotment	Invasive plant species acres*
Lower Middle Fork	A	BM	59120	195	12	247
Lower Nicoll	A	EC	3966	0	0	0
Mcclellan	A	BM	2814	1	1	0.10
Mccoy Creek	A	PC	980	1	1	0.10
Mccullough	V	BM	627	5	2	13
Mt. Vernon / John Day	A	BM	50466	58	7	27
Muddy	A	EC	6621	13	3	1
Murderers Creek	A	BM	67075	20	11	53
Myrtle	A	EC	29407	32	5	7
Ninety Six	A	BM	300	0	0	0
North Fork	A	PC	31044	109	9	38
Ott	A	PC	29991	158	7	25
Pearson	A	BM	190	0	0	0
Pine Creek	A		40328	222	4	81
Poison	A	BM	74	0	0	0
Rail Creek	A	PC	27135	2	2	0.20
Rainbow	A		30707	25	6	8
Reynolds Creek	A	PC	24028	261	7	42
Rosebud	A	BM	6912	34	5	44
Roundtop	A	BM	13708	44	7	12.5
Sawmill	A	EC	21461	2	2	0.09
Sawtooth	A		17724	43	7	237.1
Scatfield	A	EC	2327	0	0	0
Scotty Creek	A	BM	35817	7	2	13
Seneca	A	BM	19321	23	6	2
Silver Creek	A	EC	34716	6	3	1
Silvies	A	EC	8789	5	2	8
Slide Creek	A	BM	25540	32	5	27
Smoky	A	BM	9264	1	1	0.11
Snow Mountain	A	EC	12362	26	7	2
Snowshoe	A	BM	6386	2	1	0.20
Spring Creek	A	PC	57772	60	6	39
Star Glade	A	PC	1999	0	0	0
Story-Fry	A	EC	619	3	2	0.22
Sugarloaf	A		39879	43	10	6
Sullens	V	PC	46426	316	7	171
Summit Prairie	A	PC	25369	42	7	15
Upper Middle Fork	A	BM	54808	218	13	338
Van	A		6684	15	3	11

Allotment Name	Status Active (A) Vacant (V)	District	Forest land allotment acres	Number of invasive species sites mapped	Number of target invasive species mapped in allotment	Invasive plant species acres*
War Canyon	A	BM	541	0	0	0
West Malheur	A		22938	52	4	7
West Myrtle	A	EC	8541	25	4	6.50
Williams Pasture	A	BM	1146	0	0	0
Windy Point	V	BM	1306	0	0	0
Wolf Mountain	A		31608	28	6	12
York	A	BM	929	5	2	1

Table 69. Allotment use and invasive plants

Allotment Use	Allotment Acres	Invasive Plant Target Species Acres	Percent of Allotment Acreage Occupied by Target Species Plants	Percent of Total Forest Land Base Infested with Invasive Plants
Active	1,614,599	1682	0.1	0.09
Vacant	80,629	442	0.5	0.03
Total	1,695,228	2124	0.60	0.12

Grazing and Invasive Plant Spread

Seed dispersal for many species, including diffuse knap weed,, Canada thistle. scotch thistle and whitetop, is largely by wind (Bullock and Clarke 2000, CWMA 2007, USDA Forest Service 2012a, USDA Forest Service 2012b, Zouhar 2004), however, these seeds and seeds of other invasive plants present in the Malheur National Forest range allotments can also be spread by vehicles, water transport and animals (fur, hooves, and gastrointestinal ingestion and redistribution).

In areas where invasive species are interspersed with desirable forage, it is likely that seeds would either attach to fur or mud on hooves or be ingested and dispersed in feces. Some weed seeds are destroyed within the gastrointestinal tract; however, leafy spurge and spotted knapweed seeds can pass through sheep, goats, and mule deer and some of the seeds remain viable (Lacey et al. 1992). Leafy spurge seed was shown to be viable in feces 10 days post ingestion by mule deer. Long-lived seeds and hard seeded species of dicots and grasses consumed by grazers have been reported to survive passage through gastrointestinal tracts of cows and grizzly bears (Janzen 1984).

Cattle behavior along fence lines and around water developments can result in disturbed areas for invasive species to establish. According to available information, there are fewer than 3 miles of fenceline on allotments and just over 4 acres of invasive plants within 10 feet of fencelines. This would indicate that there is a high potential for weed spread from cattle trailing along fencelines on 3.25 acres. Five water developments are mapped as having invasive plants within 25 feet. Cattle disturbance around these water developments may be estimated to result in less than one acre of weed spread. These estimates suggest that cattle grazing have a lower potential to affect the spread of invasive plants than some other vectors. Also see the Cumulative Effects section for a discussion of the relative importance of various vectors. (Not all fencelines and water developments are mapped, so these estimates may be lower than actual potentials).

3.8.3 Environmental Consequences

Introduction

This section addresses the effects of the alternatives on grazing allotment administration and range resources (livestock and forage). The effect of invasive plant treatments on range administration is not a significant issue identified in chapter 1.

As project design feature N2 suggests (see table 9), range administration adjustments to protect range resources from invasive plant treatments could be necessary and would be addressed through existing administrative mechanisms such as grazing allotment management plans and grazing permits. Potential adjustments that could be used to address invasive plants or potential introductions may include:

- Changes in livestock movement patterns that require additional labor or may reduce outputs for certain allotments
- 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
- Passive restoration of native plant communities could require allotment resting for one to two seasons potentially reducing livestock use and output. In some cases fencing can be used to mitigate impacts.
- Delayed reintroduction of livestock following wildfires resulting in reduced livestock use and outputs over time

The effects spatial area is the project area and nearby adjacent private, state and other federal lands. 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. Invasive species have been present and programs existed on the Forest for the past 20 years. However, most Land Resource Management Plans in the late 1980s and early 1990s did not recognize specific details of the ecologic implications of invasive plants.

Effects Common to Action Alternatives on the Range Resource by Treatment Method

Herbicide Use

Compared to the no-action alternative, more chemicals would be used in the environment while effectively treating invasive species in the three action alternatives. The potential for a spill to occur during herbicide operations would be greater than under the no-action alternative based on the additional number of acres that would be treated. Minimal to no effects are anticipated to grazers or operators due to strict adherence to label handling directions and spill containment protocols in the unlikely event of a spill.

Livestock grazing is a known cause of invasive plant spread (DiTomaso 2000). Removal of livestock would reduce one of the vectors of invasive species spread but is not proposed as a part of this treatment project. No studies have rigorously tested this hypothesis or the effects of wild ungulates in spreading non-native plant species. Scientific support is growing for the hypothesis that large herbivores facilitate the invasion and establishment invasive plants; however, substantial controversy exists about the specific process in time and space and the associated predictions of effects. See the Introduction to Cumulative Effects section in chapter 3.1.5 for a discussion of the relative influence of grazing compared to other potential vectors on the Malheur National Forest.

Label Restrictions Relative to Range

Table 70 describes the herbicide label restrictions relevant to grazing management.

Table 70. Herbicide label restrictions relevant to range

Herbicide	Brand Name	Restriction	Remarks
Aminopyralid	Milestone Milestone VM	Grasses treated in the preceding 18 months CAN NOT be moved off the farm or ranch where harvested unless allowed by supplemental labeling. Hay treated in the preceding 18 months CAN NOT be used for silage, hayfage, baylage and green chop unless allowed by supplemental labeling. Do not use hay or straw from areas treated within the preceding 18 months or manure from animals feeding on treated hay in compost. Do not use grasses treated within the preceding 18 months for seed production.	May be used up to the edge off water.
Chlorsulfuron	Telar, Glean, Corsair, Landmark (oust + telar)	None for grazing or range administration	--
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.
Glyphosate	RoundUp, Rodeo, etc.	None for grazing or range administration	RoundUp: ingestion of this product or large amounts of freshly sprayed vegetation may cause temporary gastrointestinal irritation.
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 for grazing or range administration	--
Picloram	Tordon	Tordon 101/22K/K: allow one week of 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.	--

Effects on Mammals from Herbicide Exposure

Other herbicides could be used in later years if the first-choice herbicides are not effective (table 13 and table 5 in the project EIS). Some of these herbicides have label use restrictions that would be followed with reference to livestock grazing and/or slaughtering after 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 pdfs that require permittee notification prior to any proposed application. In addition, timely notification and coordination would occur during annual operating instruction/plan meetings and by posting/signing areas to be treated prior to and after treatment (R6 FEIS 2005).

With all herbicide use, effects on non-target vegetation may lead to secondary effects on terrestrial animals. Herbicides that may directly affect grazing animals (clopyralid, triclopyr and picloram) have label restrictions on grazing after herbicide treatment (table 70). These herbicides would have more potential for adverse effects to livestock than the first-choice herbicides, but use of label restrictions and pdfs would eliminate potential effects.

Below is information about effects of each herbicide that could be used in any of the action alternatives. The information is derived from SERA risk assessments. In the risk assessment methodology, hazards to target organisms are measured as a hazard quotient (HQ). A hazard quotient of 1 or greater is considered to be of concern.

Aminopyralid (SERA 2007): Non-target forage plants may be killed by direct spray or spray drift. There is no indication that tolerant species of terrestrials plants (such a grasses), aquatic plants (algae or macrophytes), mammals, birds, aquatic or terrestrial invertebrates, terrestrial microorganisms, fish, and amphibians will by adversely affected by aminopyralid (SERA 2007).

Clopyralid (SERA 2004b): Appears to be relatively non-toxic to terrestrial or aquatic animals; it is highly selective in its toxicity to terrestrial plants, and relatively non-toxic to aquatic plants. Thus, the potential for substantial effects on non-target species appears to be remote. However, some decreased body weight has occurred in rats at lowest dose levels. Effects on liver and kidney weight as well as changes in gastric epithelial tissue have also been noted at dose levels similar to those associated with changes in body weight.

Chlorsulfuron (SERA 2004): Non-target forage plants could be killed by drift or runoff. Off-site runoff of chlorsulfuron could be substantial in conditions that favor runoff. The available data are sufficient to assert that no adverse effects are anticipated in terrestrial animals that do not directly depend on the weeds that are targeted (SERA 2004).

Glyphosate (SERA 2011b): There are numerous formulations of glyphosate. In the risk assessment, distinctions are made between more and less toxic formulations. At the unit application rate of 1 lb. a.e./acre, none of the hazard quotients for mammals exceed the level of concern (HQ=1). At application rates of 2.5 lb. a.e./acre or less, worst-case exposure assessments indicate that mammals are not at risk. As discussed in Section 4.1.2.1, this risk characterization is supported by well-documented field studies that failed to identify adverse effects in populations of small mammals following applications of Roundup as well as another unidentified formulation of glyphosate

Less toxic formulations of glyphosate pose no apparent risks to mammals. At the unit application rate of 1 lb. a.e./acre, the highest HQ for any mammalian receptor is 0.005, which is associated with the consumption of contaminated water following an accidental spill. At the maximum aquatic application rate of 3.75 lb. a.e./acre, the HQ for the accidental spill would be about 0.02 [(0.005/1 lb. a.e. per acre) x 3.75 lb. a.e./acre = 0.01875], which is below the level of concern by a factor of 50.

Imazapic (SERA 2004d): The weight of evidence suggests that no adverse effects in mammals or birds are plausible using typical or worst-case exposure assumptions at the typical application rate of 0.1 lb./acre or the maximum application rate of 0.1875 lb./acre. The available data are sufficient to assert that no adverse effects are anticipated in terrestrial mammals or birds.

Imazapyr (SERA 2011c): For aquatic applications, none of the HQs approaches a level of concern. The highest HQ of 0.009 is associated with the upper bound of the HQ for a canid consuming contaminated fish following an accidental spill. This HQ is below the level of concern (HQ=1) by a factor of over 100. None of the hazard quotients for terrestrial applications exceed the level of concern. The highest HQs are associated with consumption of contaminated grass by a small mammal—i.e., HQs of 0.2 (0.02 to 0.9). All exposure scenarios for all larger mammals are no greater than 0.2, below the level of concern by a factor of 5.

Metsulfuron Methyl: Non-target forage plants could be killed by drift or runoff. Off-site runoff of metsulfuron methyl could be substantial in conditions that favor runoff. The available data are sufficient to assert that no adverse effects are anticipated in terrestrial animals that do not directly depend on the weeds that are targeted (SERA 2005).

Picloram (SERA 2011d): There are no clear organ-specific pathological effects are associated with picloram, and the most sensitive endpoints appear to be nonspecific alterations in the staining properties of liver tissue with altered liver and kidney weights noted at higher doses.

Surfactants: Surfactants are one type of adjuvant that makes herbicides more effective by increasing absorption into the plant. Many of the inert ingredients are proprietary in nature and have not been tested on laboratory species. However, confidential business information (i.e. the identity of proprietary ingredients) was used in the preparation of the herbicide risk assessments. Surfactants are discussed in chapter 2 of the project EIS and limitations for their use are listed in the pdfs.

Triclopyr (SERA 2011): The only exposure scenario of concern is the ingestion of contaminated vegetation. Aquatic applications of triclopyr do not present apparent or identifiable risks to humans. The HQs for mammals increase as body weight increases. While small mammals may consume more than larger animals, the higher sensitivity of larger mammals to triclopyr suggest they are at greater risk. At the unit application rate of 1 lb. a.e./acre, the acute HQs for a large (70 kg) mammal consuming contaminated short grass are 2 (0.2 to 11). The corresponding chronic HQs are 5 (0.2 to 53).

Based on relatively standard methods used to estimate risks to mammals from well-conducted toxicity studies as well as reasonably well- documented estimates of exposure, it is likely when using triclopyr that mammals would be exposed to doses that exceed the level of concern (Hazard Quotient, HQ=1). In extreme cases, adverse effects could be anticipated in some mammals, particularly larger mammals, at application rates as low as 1 lb. a.e./acre. These effects, however, might not involve overt signs of toxicity that would be observed in field studies.

Chronic HQs for mammals are substantially higher than the acute HQs. This suggests that while overt signs of toxicity might not be evident shortly after triclopyr applications, longer-term adverse effects on mammalian populations, possibly involving changes in reproductive rates, could occur. While these effects are not reported or otherwise noted in field studies, available field studies focus on small mammals, and the available literature does not include longer-term studies on populations of larger mammals (carnivores or herbivores).

Exposure scenarios not involving the consumption of contaminated vegetation—i.e., direct spray and the consumption of contaminated water and fish—lead to HQs for triclopyr that are far below the level of concern. The only residual concern with mammals following aquatic applications of triclopyr involves the treatment of emergent vegetation. It seems reasonable that mammals could feed on treated emergent vegetation shortly after triclopyr was applied. Methods to estimate doses from this type of exposure are not available. By analogy to the consumption of terrestrial vegetation by mammals, mammals consuming treated emergent aquatic vegetation could be exposed to triclopyr at levels which might exceed the level of concern.

Adjuvants/Surfactants (Bakke 2002, 2003): Surfactants are one type of adjuvant that makes herbicides more effective by increasing absorption into the plant. Many of the inert ingredients are proprietary in nature and have not been tested on laboratory species. However, confidential business information (i.e. the identity of proprietary ingredients) was used in the preparation of the herbicide risk assessments. Surfactants are discussed in chapter 2 of the project EIS and limitations for their use are listed in the pdfs.

Other Treatment Methods

Manual treatments would be used in small areas and would not likely affect livestock except to remove the invasive plants including potentially toxic species and potentially increase the amount of forage. Mechanical treatment would most likely involve mowing along roadsides. Mechanical treatments would not likely affect livestock use. It would temporarily remove invasive plants, but would not eliminate them. Biological controls would reduce amounts of invasive plants and allow for native species to expand. Cultural controls would be used in very small areas and would not likely affect livestock.

An actual reduction in Animal Unit Month (AUM) 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. All action alternatives would include restoration, where needed, to facilitate recovery of native plants.

Early Detection and Rapid Response

In addition, new or previously undiscovered infestations could be treated using the range of methods described in this EIS. An early detection and rapid response (EDRR) approach is needed because (1) the precise location of individual target plants, including those mapped in the current inventory, are subject to rapid and/or unpredictable change, and (2) the typical NEPA process does not allow for rapid response to new detections; infestations may grow and spread into new areas during the time it usually takes to prepare NEPA documentation. The intent of the project early detection and rapid response approach is to treat new infestations when they are small so that the likelihood of successful treatment is maximized and adverse effects are minimized.

The action alternatives would allow treatment of new detections (EDRR), as long as the treatment method is within the scope of this EIS. The treatment of newly found sites adds additional risk factors to wildlife just by adding additional exposure areas. This also expands the treatment into areas that may not have been originally anticipated. However, the implementation planning process identified in chapter 2 would be used with each new infestation site to determine treatment. The pdfs have been set up to provide layers of caution so that even if the exact locations are not known, the potential for adverse effects are minimized. Implementation of pdfs and herbicide-use buffers and treatment limits would work together to provide sideboards to deal with the uncertainty of treating new sites (USDA Forest Service 2008b).

Direct, Indirect and Cumulative Effects of Alternative A

Implementation of alternative A means there would be no treatment and no direct, indirect, or cumulative effects on range. Invasive plants would continue to degrade livestock forage and could spread into neighboring rangelands. Alternative A would limit our ability to meet the purpose and need and would not comply with current management direction relative to invasive plants and range.

Direct and Indirect Effects of Alternative B

Effective invasive plant treatments on grazing allotments would help retain and increase the native vegetation that provides livestock forage. Livestock exposure to toxic weed species would be reduced.

First-choice herbicides proposed for alternative B are expected to have no adverse effects to livestock. Other herbicides that may be used have some potential impacts on livestock as discussed above but

impacts would be eliminated due the pdfs that keep rates low and the coordination with permittees that ensures pdfs and label requirements for moving livestock during spraying are followed (table 9, N Group).

There are no restrictions on livestock use for the first-choice herbicides. There are restrictions on uses of grass, hay and straw sprayed with aminopyralid, but none for livestock grazing. There are grazing restrictions with use of clopyralid, imazapic, picloram and triclopyr.

Project design features would be adequate to prevent effects to livestock.

Given the relatively short half-lives, the low rates of application proposed and the minimal effects of the first-choice herbicides proposed under alternative B, it is not likely that repeated applications in the same areas would have effects to livestock. Herbicide risk assessments considered chronic exposure, and even under those scenarios, effects were below the established thresholds.

Management such as timing and duration of grazing, patterns of use, requirements to use only weed-free feed, and the potential of quarantine periods if these activities are implemented on allotments. Operators may experience a slight loss of grazing opportunity; however, many of the grazing strategies within allotments have deferred rotations and by focusing invasive weed treatments to the pastures during the resting phase would avoid most or all potential impacts to operators.

Alternative B would be more effective at reducing invasive plants (80 percent) than the other alternatives and restoration may begin sooner, so benefits of invasive weed treatment would be experienced earlier under alternative B.

Direct and Indirect Effects of Alternative C

This alternative would result in fewer acres of herbicide use and would allow only spot herbicide use within 100 feet of streams and within 200 feet of wells. Picloram would not be used. Impacts to livestock operators would be similar to those described in alternative B. The potential for exposure of livestock and livestock managers would be slightly decreased as less chemical would be used within riparian areas. Livestock would not be exposed to effects from picloram.

Manual and mechanical treatments would increase. Approximately1,389 acres would need to be treated solely with non-herbicide methods. Non-herbicide treatments would not affect livestock, but treatments in riparian areas where cattle congregate could result in short periods of bare soils that could result in increased erosion and sedimentation with cattle use. As noted in chapters 3.4 and 3.5, sediment delivery from this project would be minimal.

Direct and Indirect Effects of Alternative D

Compared to alternative B, more chlorsulfuron, glyphosate, metsulfuron methyl, and picloram, would be used instead of aminopyralid. The herbicide use rates, pdfs and herbicide-use buffers associated with aminopyralid would become non-applicable. Alternative D would have less broadcast spraying and more spot spraying, so there would be less potential for damaging or destroying non-target vegetation and forage. Alternative D would use picloram on 27 acres. Picloram has the potential for adverse effects to livestock, but project design features and label restrictions would lower risks. When picloram is used, grazing would be eliminated during herbicide treatment until poisonous plants are dry and no longer palatable. Grazing animals used for meat would be removed from treated areas for 2 weeks after treatment and 3 days prior to slaughter. Project design features are adequate to prevent harmful herbicide exposure to livestock. Permittees would be notified of herbicide application and would be required to move cattle to follow pdfs and herbicide label restrictions.

Cumulative Effects of Action Alternatives

Long-term effects of the action alternatives would be beneficial to range resources. Implementation of action alternatives would gradually reduce the extent and abundance of invasive plant species on range allotments. Coordination with neighbors would increase weed control effectiveness on adjacent land ownerships because aggressive treatment would reduce invasive infestations on National Forest system land and less weed seeds and fewer invasive plants would spread onto neighboring lands. As the spread of invasive species on National Forest System lands decreases, the likelihood of weeds spreading onto private, tribal, state and lands of other ownerships would also decrease. Over time, this could reduce herbicide use on National Forest and adjacent land ownerships.

Since grazing allotments cover essentially the entire Malheur National Forest, any activities that produce ground disturbance on the Forest may increase the spread of invasive plants and reduce the amount of forage available for livestock. Therefore, although treatments proposed under alternative B would reduce invasive infestations and all management activities follow guidelines to prevent or reduce the spread of weeds, new infestations or spread of remaining infestations would continue to occur. As a result, herbicide applications would likely continue to be needed over time. We expect, however, that after current infestations are reduced or eradicated with initial treatments, follow-up treatments and treatments of new infestations would require less herbicide over smaller areas. Herbicide treatment of invasive species on lands near or adjacent to the Forest would likely continue, and amounts, types, and methods of application cannot be anticipated.

The action alternatives all include the EDRR component allowing treatment of newly detected infestations; however, other landowners may or may not have the flexibility, funds or staffing to implement EDRR. Because the extent of future treatment programs on lands of other ownerships is unknown, the effect this would have on invasive plants migrating onto National Forest System lands is also unknown.

Table 25 and table 26 list projects and activities that are ongoing or foreseeable for the Malheur National Forest. The other projects do not involve weed treatment or herbicide use. Since no direct or indirect effects to livestock or range management are expected, this project would not add to any effects from those projects and activities. Therefore, there would be no adverse cumulative effects to range resources from this project. In the long term, all action alternatives would favor re-establishment of desirable plant communities within the project area and across ownership boundaries, especially where coordinated treatments occur.

3.9 Recreation and Special Places

3.9.1 Introduction

Introduction of invasive species can have notable impact on recreation resources and activities. These affects may have a range of effects depending on species, plant architecture, plant chemical composition, and/or associated environmental alteration.

Invasive species may be introduced at developed campgrounds, dispersed camp sites, trailheads, snow parks i.e., recreation parking areas for unloading/loading snow machines, boat launch areas, visitor centers or interpretive sites. Even more insidious is when invasive species are introduced along trails or at remote wild and scenic, wilderness, or other back country areas. In these special designated areas detection, mapping, and treatments may often presents a greater challenge. Wilderness or Wild River special areas typically prohibit use of motorized equipment for treatment, and often may restrict other treatments commonly used in other areas such as biological control.

The section of the EIS discusses potential herbicide effects on people and animals when used in areas frequented by recreationists such as campgrounds, dispersed camping sites, interpretive sites, and trail systems. It also addresses the effects of herbicide use changing the wild character of roadless areas (IRAs), Wildernesses, Wild and Scenic Rivers (WSR), National Scenic Areas (NSA), National Scenic Trails (NST), and Research Natural Areas (RNA).

The public has expressed concerns about herbicide use in these special areas, as well as preventing or controlling invasive species vectors associated with recreational uses including OHV travel, recreation stock use, and other traditional recreation uses such as site seeing, recreational driving, hiking, camping, and picnicking.

The Forest Service uses a nationally recognized classification system called the Recreational Opportunity Spectrum (ROS) to describe different recreation settings, opportunities, and experiences that help guide recreation management decisions and activities on National Forest lands (USDA Forest Service 1986).

ArcGIS 9.3.1 geographic information system (GIS) was used to analyze the proposed activities in regards to recreation use and facilities, dispersed recreation sites, and the recreation opportunity spectrum (ROS) classes within the project area. The recreation analysis considered the area within the project area, unless otherwise noted. Estimates of recreation use are derived from the National Visitor Use Monitoring (NVUM) inventories done on the Malheur NF in 2003-04 and 2009-10. These inventories are conducted for all national forests on a 5-year cycle. These two NVUM surveys are the basis for estimating present recreation use and demand and for projecting the growth of recreation use on the Malheur NF.

Data Gaps and Limitations

The NVUM inventory process has limitations that should be understood. Visitor use is measured at specific predetermined recreation sites falling into high, medium, or low use categories. Small or little used sites are not included in the inventories. However, they may represent a significant contribution to a given recreation pursuit and not be adequately represented in the data. In addition, participation is voluntary and some visitors, or activities, may better lend themselves to interviewing. For example, a party pulling a pack string may be less inclined to participate because the disruption may provide opportunity for the string to get into trouble. Consequently, the data is collected from a segment that is willing or able to participate and extrapolated to represent visitor use as a whole.

Invasive species survey data for Wilderness Areas, Wild portions of the Wild and Scenic Rivers, and for the Scenic Area are limited. Invasive species surveys in these more remote areas with limited access makes surveying for invasive species a more time and funding intensive workload.

3.9.2 Affected Environment

Recreation Uses

Recreation use was inventoried on the Malheur National Forest during the years 2004 and 2010. There was a dramatic decrease in the total number of forest visitors between the two sample dates. In 2004 Forest visits were estimated at 422,666 person days compared to only 261,400 person days in 2010, nearly a 40% decline in the number of forest visits between the two sample years.

The NVUM system was used to capture the data. The Recreation Report provides detailed data showing that hunting is a major use on the Forest, along with driving for pleasure, camping, hiking, relaxing and viewing wildlife. Most of these activities necessitated the use of motorized vehicles to access all or part of the activity. This consistent association between recreation activities and motorized use is an important consideration for successful invasive species management on the Forest.

Wilderness

The Forest contains two Wilderness Areas, Strawberry Mountain (68,700ac.) and Monument Rock (12,620 acres, see maps in the recreation report). The Wilderness Act prohibits motorized or mechanized use, major invasive species vectors, within wilderness area boundaries. However, recreationist, pets, pack stock, livestock grazing, wildlife, and natural seed dispersal have successfully introduced invasive species into these wilderness areas.

Current invasive species surveys have documented 2.2 acres of invasive plant infestations at 8 locations in the wildernesses. The wilderness surveys are not considered to be complete and ongoing awareness and additional surveying will be essential for managing invasive species within these special areas. In addition, invasive plant sites occur at or near some of the wilderness trail heads and on roads leading to, and adjacent to, the wilderness areas. It is likely more infestations will arise in the future. Higher use levels such as near trail heads, along trails, in riparian areas, in recent burns, or in concentrated use campsites are known vectors for spread (see chapter 3.1).

Wild and Scenic Rivers

Two congressionally designated wild & scenic rivers (WSR) lie within the Forest, the Malheur River WSR and the North Fork of the Malheur WSR (see maps in the recreation report). The Malheur River WSR is 12 miles long with 6 miles designated as Wild and 6 miles designated as Scenic. The WSR corridor is comprised of 2,961 acres designated wild and 797 acres designated scenic totaling 3,758 acres. The North Fork of the Malheur River WSR is designated a scenic WSR for 22.9 miles with the corridor encompassing 7,034 acres.) The Malheur Forest Plan, as amended by their respective Malheur and North Fork Malheur WSR Plans, generally prohibits motorized use off Forest system roads and trails within both the Scenic and Wild boundaries of both of rivers. These motorized access restrictions will aid in reducing the risk of introducing invasive plant species. There remain other vectors associated with recreational uses, e.g. dispersed campsites, hiking, horseback riding, and livestock grazing in some areas, which may serve as vectors for invasive plant species. Current invasive plant surveys in the WSRs indicate infestations totaling 0.9 acres. Additional infestation will most likely be associated with areas of heavier use, such as near trail heads, along the river riparian zones, along trail, in concentrated campsites, and in recent burns.

Inventoried Roadless areas (IRA)

Inventoried Roadless Areas (IRA) were identified under the 2001 Roadless Area Conservation Rule. Nineteen IRAs are designated on the Malheur National Forest (maps in the recreation report). These IRAs have a total of 188 acres of Forest lands. The Forest Plan recognizes these special areas as a combined portions of the Semi-Primitive Non-Motorized, Semi-Primitive Motorized, and Wild and Scenic River Management Areas (MAs 10, 11, and 22). The motorized vehicle restrictions in portions of the IRAs, are somewhat similar to restrictions in Wild and Scenic Rivers corridors and Semi-Primitive Non-Motorized management areas. This will aid in reducing the likelihood of invasive species introduction and spread within IRAs via motorized recreation activities. The Semi-Primitive motorized IRA would have reduced motorized access, and hence less potential for infestation spread by motor vehicle access but not quite to the extent enjoyed by Wilderness and Wild Rivers areas. Current IRA invasive plant infestations total 25 acres comprised of 50 known location. Additional infestations will most likely occur in areas receiving heavier visitor use, such as along trail, in riparian zones, in concentrated campsites, and in recent burns.

Table 71. Acres of Inventoried Roadless Areas

Inventoried Roadless Area	Acres
Aldrich Mountain	4,924.72
Baldy Mountain	6,415.93
Cedar Grove	113.98
Dixie Butte	12,207.98
Dry Cabin	12,273.64
Flag Creek	7,716.41
Fox Creek	5,845.93
Glacier Mountain	19,568.38
Greenhorn Mountain	15,927.16
Jumpoff Joe	3,889.62
Malheur River	7,282.54
Mcclellan Mountain	21,213.02
Myrtle Silvies	11,678.69
Nipple Butte	11,353.90
North Fork Malheur	18,068.60
Pine Creek	5,461.57
Shaketable	6,763.89
Silver Creek	7,948.20
Utley Butte	9,699.11
Total IRA Acreage	**188,353.26**

National Scenic Areas

The Malheur National Forest has one National Scenic Area, the Vinegar Hill – Indian Rock Scenic Area comprised of 17,234 acres (see map in recreation report). The management direction for Scenic Areas is to manage this area to preserve and protect outstanding natural esthetics. Current known invasive plant infestations total 2.4 acres. Motorized travel is restricted within the NSA to winter use only. As with other special areas that prohibit or restrict motorized access, a major source of invasive introductions, the likelihood of introducing or spreading invasive species is commensurately reduced. Additional infestations will most likely occur in areas receiving heavier visitor use, such as along trail, in riparian zones, in concentrated campsites, and in recent burns.

Other Semi-Primitive Areas

Recreation opportunities on the Malheur NF are focused toward meeting forest management objectives as identified in the Malheur Forest Plan. However, the rise in motorized activity over the past two decades represents a substantial change with profound potential toward affecting opportunities within the full (recreation opportunity spectrum) ROS. An increase in motorized activity in the more primitive ROS holds the potential for introducing and spreading invasive species into less frequented areas, hence decreasing the likelihood of implementing EDRR (early detection and rapid response).

Maintaining a road infrastructure in the face of shrinking budgets is increasingly problematic and has resulted in an increase in the number of “challenging” and rugged roads on the Forest, e.g. Deer Creek or Crane Crossing. In addition, management presence has diminished generally across the Forest as budgets for field going personnel and signing has diminished. When considered in combination, the extensive road system, predominant importance of road based recreation activities, and low forest service presence increase the opportunity for invasive species establishment and overall diminish the success of

implementing and effective EDRR strategy. Protection of primitive areas are of particular interest and concern.

3.9.3 Environmental Consequences

Introduction

Table 72 below shows the number of invasive plant sites currently within recreation resource areas and how many acres are proposed for herbicide treatment based on the current inventory.

Table 72. Number of invasive plants by Recreation Resource Area and Alternative

Recreation Resource Areas	Number of known sites	Alt. A	Alt. B	Alt. C	Alt. D
Wilderness Acres	8	0	2.2	2.2	2.2
Wild and Scenic Rivers Acres	15	0	0.9	0	0.9
Scenic Areas Acres	4	0	2.4	2.4	2.4
Other Semi-Primitive Areas (ROS) Acres	15	0	4.2	4.2	4.2
IRAs Acres	50	0	61.2	61.2	61.2
Acres Within 500 meters of developed recreation Sites	108	0	121	121	121

The analysis area encompasses these types of recreation areas.

Alternative A – No Action

Under the no-action alternative there would be no direct effects to the Malheur National Forest recreation resource areas of Wilderness, Wild and Scenic Rivers, Scenic Areas, Semi-Primitive Non-Motorized ROS areas, IRAs, and developed and dispersed recreation sites.

The current infestation would most likely continue to expand and new infestation sites would be expected to be established. Over time it would be expected that the Wilderness character and values would be negatively affected by expanding infestations. The Wild and Scenic River Outstanding Remarkable Values (ORV) would be negatively affected by expanding infestations. The Scenic Area outstanding natural esthetics would be negatively affected by expanding invasive species infestations. Over time, the SPNM and IRA area's biological and botanical environments would be negatively affected by expanding infestations. Degradation of the biological and botanical environments would further degrade the natural beauty and character of the SPNM and IRA areas.

Dispersed recreation also occurs throughout the Malheur National Forest. Dispersed recreation includes a wide variety of activities including hunting, fishing driving for pleasure, firewood cutting, horseback packing and riding, road and mountain biking, camping, picnicking, wild plant collecting (mushrooms, camas, ferns, and etc.), and OHV riding. Over time it would be expected that the scenic and natural appearing forest character of dispersed recreation sites would be impaired depending on the particular recreation activity and the nature of the invasive infestation.

Direct and Indirect Effects of Action Alternatives

All action alternatives provide for some level of effective invasive species treatments. These alternatives differ in that alternative C imposes strict limitations on herbicide application and alternative D, while similar to alternative B, would not provide for application of aminopyralid. Alternative C would eliminate broadcast spraying, eliminate picloram, prohibit herbicide application in Riparian Habitat Conservation Areas, i.e. including the Wild and Scenic River corridors, and establish herbicide free buffers of 100 feet from creeks, lakes, ponds, and wetlands.

Wilderness Areas

Invasive species would continue to be pulled by hand or hand tools where practical. Cultural, mechanical and motorized control methods would not be utilized in Wilderness areas. Herbicide application would be used in accord with the pdf prescribed using non-motorized methods such as spot spraying with backpack or mule packed application equipment.

Infestations that would impact wilderness character and values would be evaluated for treatment and if suitable given a high priority for treatment. New sites would be evaluated for suitable treatment(s) using the EDRR process. In order to conduct treatments other than hand pulling a minimum decision analysis would be conducted and documented.

The use of herbicides in Wilderness Areas may reduce the wilderness experience for some users in the short term, but active treatment provides the best protection of wilderness character and values. The purpose and need for invasive plant treatment is not driven primarily by convenience or administrative cost. In addition Invasive plants have an adverse effect by disrupting natural processes. Invasive species may alter native plant communities and have indirect effects with wildlife species that rely on the native plant communities. Invasive species may also alter fire regimes that may ultimately alter wilderness ecological processes.

By utilizing the appropriate pdf it is anticipated invasive species infestations would be eliminated, reduced, and the rate of spread retarded. This would result in recovery or protection of wilderness character and values. It is likely that most sites discovered in wilderness in the future would be relatively small infestations and the effects of treatment would be minor. The visual impact of the short lived blue dye may result in visual impacts to the recreation experience of some visitors. However, these effects would be short term and limited to the vicinity of the treated site. Compared with implementing alternative B, alternative D is estimated to decrease cost effectiveness; and alternate C is estimated to be provide less effective and be less cost effective.

Wild and Scenic Rivers

Infestation sites in the Wild and Scenic River corridors would be treated. Depending on the chosen alternative the treatment method would vary among alternative by the method and herbicide used. Compared with implementing alternative B, alternative D is estimated to decrease cost effectiveness. Under alternative C no herbicide would be used in the WSR corridor and treatment would consist of hand pulling, cultural, and mechanical methods. It is estimated using alternative C would be less effective overall in treating infestations.

The use of herbicides in Wild and Scenic Rivers may reduce the ‘wild’ experience for some users in the short term especially in the Wild designated corridor, but active treatment provides the best protection of the outstanding and remarkable values. Treating Wild and Scenic River infestations would have short term adverse effects by introducing human manipulation, but would result in long term beneficial effects to wilderness character and values by restoring natural conditions.

By utilizing the appropriate pdf treatment methods it is anticipated invasive species infestations would be eliminated, reduced, and the rate of spread retarded. This would result in recovery or protection of Wild and Scenic ORVs. It is likely that most sites discovered within the Wild and Scenic River corridors in the future would be relatively small infestations and the effects of treatment would be minor. The visual impact of the short lived blue dye may result in visual impacts to the recreation experience of some visitors. However these effects would be short term and limited to the vicinity of the treated site.

Scenic Areas

Infestation sites in the Scenic Area would be treated by hand pulling, mechanical, motorized (where accessible), cultural, and herbicide application. Depending on the chosen alternative the treatment method would vary among alternative by the method and herbicide used. Under alternative C no herbicide would be used in RHCAs and treatment would consist of hand pulling, cultural, and mechanical methods. It is estimated using alternatives C and D would be less effective overall in treating infestations due to the limitations on herbicide type and allowed use.

By utilizing the appropriate pdf treatment methods it is anticipated invasive species infestations would be eliminated, reduced, and the rate of spread retarded. This would result in recovery or protection of the outstanding natural esthetics of the Scenic Area. It is likely that most sites discovered within the Scenic Area in the future would be relatively small infestations and the effects of treatment would be minor. The visual impact of the short lived blue dye may result in visual impacts to the recreation experience of some visitors. However these effects would be short term and limited to the vicinity of the treated site.

ROS Semi-Primitive Non-Motorized (SPMN) and Inventoried Roadless IRAs

Infestation sites in the SPMN and IRA areas would be treated by hand pulling, mechanical, motorized (where accessible), cultural, and herbicide application. Depending on the chosen alternative the treatment method would vary among alternative by the method and herbicide used. Under alternative C no herbicide would be used in RHCAs and treatment would consist of hand pulling, cultural, and mechanical methods. It is estimated using alternative C and D would be less effective overall in treating infestations due to the limitations on herbicide type and allowed use.

By utilizing the appropriate pdf treatment methods it is anticipated invasive species infestations would be eliminated, reduced, and the rate of spread retarded. This would result in recovery or protection of the native biological and botanical environments. It is likely that most sites discovered within the SPNM and IRA areas in the future would be relatively small infestations and the effects of treatment would be minor. The visual impact of the short lived blue dye may result in visual impacts to the recreation experience of some visitors. However these effects would be short term and limited to the vicinity of the treated site.

Recreation Sites

Infestation sites in and near recreation sites would be treated by hand pulling, mechanical, motorized (where accessible), cultural, and herbicide application. Depending on the chosen alternative the treatment method would vary among alternative by the method and herbicide used. Under alternative C no herbicide would be used in RHCAs and treatment would consist of hand pulling, cultural, and mechanical methods. It is estimated using alternative C and D would be less effective overall in treating infestations due to the limitations on herbicide type and allowed use.

By utilizing the appropriate pdf treatment methods it is anticipated invasive species infestations would be eliminated, reduced, and the rate of spread retarded. This would result in recovery or protection of the scenic and natural appearing forest character. It is likely that most sites discovered within and near the recreation sites in the future would be relatively small infestations and the effects of treatment would be minor. The visual impact of the short lived blue dye may result in visual impacts to the recreation experience of some visitors. However these effects would be short term and limited to the vicinity of the

treated site. Recreation sites undergoing treatment would be marked and forest visitors would be discouraged from recreating in the vicinity of sites recently treated and may choose to relocate to alternative recreation sites. However this effect would be of short duration.

Dispersed Recreation

Infestation sites in and near dispersed recreation sites would be treated by hand pulling, mechanical, motorized (where accessible), cultural, and herbicide application. Depending on the chosen alternative the treatment method would vary among alternative by the method and herbicide used. Under alternative C no herbicide would be used in RHCAs and treatment would consist of hand pulling, cultural, and mechanical methods. It is estimated using alternative C and D would be less effective overall in treating infestations due to the limitations on herbicide type and allowed use.

Dispersed recreation occurs throughout the Malheur National Forest. Dispersed recreation includes a wide variety of activities including hunting, fishing driving for pleasure, firewood cutting, horseback packing and riding, road and mountain biking, camping, picnicking, wild plant collecting (mushrooms, camas, ferns, and etc.), and OHV riding. Dispersed recreation most likely will occur in all of the treatment areas to some extent. By utilizing the appropriate pdf treatment methods it is anticipated invasive species infestations would be eliminated, reduced, and the rate of spread retarded. This would result in recovery or protection of the scenic and natural appearing forest character. It is likely that most sites discovered within and near dispersed recreation sites in the future would be relatively small infestations and the effects of treatment would be minor. The visual impact of the short lived blue dye may result in visual impacts to the recreation experience of some visitors. However these effects would be short term and limited to the vicinity of the treated site. Dispersed recreation sites undergoing treatment would be temporarily marked and forest visitors would be discouraged from recreating in the vicinity of sites recently treated and consequently may choose to relocate to alternative recreation sites. However this effect would be of short duration.

Cumulative Effects

There are some foreseeable projects in recreation special uses that most likely will have additional invasive species effects. In 2011 the Forest completed implementation of the 2007 revised Outfitter-Guide policy. It is likely the Malheur National Forest will issue a minor number of special use permits for providing recreation services on Forest lands. The public has expressed interest or obtained temporary special permits in the recent past in obtaining special use permits for such activities as back packing trips in the Wilderness areas, ice climbing, road biking tourism, mountain biking tours, hunting, and horse day rides. As with current recreational activities, these additional services have the potential to act as invasive species infestation vectors.

It is also likely the Malheur National Forest will implement the 2005 Travel Management Rule in the foreseeable future. Two likely effects of addressing former Chief Bosworth's four threats including "unmanaged recreation" (http://www.fs.fed.us/projects/four-threats/) are an increased use of OHVs on some Forest System roads and a dramatic reduction in cross country OHV use. It is likely any increased recreation use on roads will commensurately increase the likelihood of invasive species infestations. However, eliminating uncontrolled cross country travel is anticipated to significantly reduce the risk of invasive species infestations along closed roads and in the general forest area (GFA) no longer accessible to unmanaged OHV travel.

Because the effects of invasive plant treatments on recreation and scenic resources are minimal, limited, localized, and short-term, there is very little chance the effects would accumulate with effects brought on by past, present or future management activities.

3.10 Archeological Resources

3.10.1 Introduction

This section focuses on archaeological resources

The USDA Forest Service Advisory Council on Historic Preservation (ACHP) and the Oregon State Historic Preservation Office (SHPO), have a 2004 programmatic agreement addressing the management of cultural resources on national forests in the State of Oregon. There are several actions that were determined to have no potential to affect historic properties (appendix C). Examples of these actions include invasive plant species eradication through the application of herbicides and hand removal (including hand tools such as shovels to dig up roots); recurrent brushing (hand, machine, chipping) activities to control vegetation within clearing limits of existing roads, trails, parking lots, and power line corridors; mulching and re-vegetating bare, erosion-prone surfaces such as cuts and fills; and re-introduction of endemic or native floral species into their historic habitats.

Specific treatments that would be classified as actions with no potential to affect cultural resources, and therefore subject to Forest Specialist approval, on behalf of SHPO, include the following:

- Herbicide Application Methods (selective/hand, spot, and broadcast spray)
- Cultural Methods limited to stock grazing
- Manual/Mechanical Methods (mowing, weed whipping, and hand pulling)
- Manual/Mechanical Methods (grubbing and wrenching) in areas that occur on landslides, flood deposits, previously surveyed areas where no archaeological sites occur, skid trails, landings, and road cuts and fill.

3.10.2 Affected Environment

The Malheur National Forest lies at the interface between the Columbia Plateau and Great Basin Culture Areas, and has been used by native peoples for thousands of years. To date, more than 5,000 archaeological sites have been identified within the Forest. Site-specific information regarding archaeological, historical, and traditional cultural resources is not presented in this document. The potential for impact is minor and short term to non-existent so site-specific archaeological information is not needed to make an informed decision. Comprehensive Archaeological Resource information is on file at the Malheur National Forest Headquarters in John Day, Oregon.

3.10.3 Environmental Consequences

Introduction

Effects to archaeological resources are assessed for each treatment method: manual, mechanical, cultural, and herbicide. Most of the proposed treatment areas have been previously disturbed by present day human activities such road construction and use (shoulders, cuts and fills). Archaeological sites are sometimes bisected by high use areas such as road and thus could overlap invasive plant infestations. Geographic areas proposed for treatment include roadsides, quarries, administrative sites, campgrounds, parking areas, artificial clearings, meadows, and forested areas. Archaeological resources may occur in all of these locations although they may not be affected by the project, depending on the ground-disturbing potential of the action.

Alternative A – No Action

No action means that no treatments would take place and thus, no direct, indirect or cumulative impacts on archaeological resources would occur.

Action Alternatives

Most of the treatment methods are not ground disturbing and therefore would have no direct or indirect effect on archaeological (cultural) resources. The sole exception may be weed wrenching and grubbing, manual techniques that have potential to disturb archaeological resources to a minor degree.

Should any action alternative be implemented, project design features would minimize or eliminate potential impacts, which are already of a minor nature. If weed wrenching and grubbing with a shovel is planned in areas that are outside landslides, flood deposits, previously surveyed areas, skid trails, landings, road shoulders, cut and fills, the Forest Service archaeologist would have an opportunity to review treatment locations to determine if archaeological resources could be affected. Weed wrenching and grubbing techniques will not be used in known archaeological sites. Alternative treatment methods will be selected from those that would have low potential to affect archaeological resources. With application of the pdf, no significant direct or indirect adverse effects to archaeological resources are anticipated, and no contribution to cumulative adverse effects would occur.

Tribal Consultation and Treaty Rights

The Forest Service has communicated by letter with three affected tribes: The Confederated Tribes of the Warm Springs, the Confederated Tribes of the Umatilla Indian Reservation, and the Burns Paiute Tribe. The Forest Service outlined the project details and potential effects to archaeological resources.

The Warm Springs and Umatilla tribes signed treaties with the federal government in 1855 and later ratified by Congress. These treaties ceded to the United States legal title to millions of acres of land, and reserved and guaranteed certain rights exercised by Indian people to fishing, hunting, gathering roots and berries, and other activities. An 1868 treaty with the Burns Paiute Tribe was never ratified by Congress.

Executive Order 12898 directs federal agencies to consider patterns of subsistence hunting and fishing if an action will affect fish and wildlife. Under the proposed action, no adverse effects to treaty fishing sites, traditional cultural plant gathering areas, traditional plants, or subsistence related activities would occur.

The risk associated with direct herbicide contact and with ingesting contaminated fish, berries, or other plants is discussed in Section 3.2 Human Health. Given the types of treatments considered and the project design features (pdf), no direct, indirect, or cumulative adverse effects on tribal or treaty rights would occur.

3.11 Specifically Required Disclosures

3.11 1 Irreversible or Irretrievable Impacts

No irreversible or irretrievable uses of resources are associated with this project. This project restores native vegetation in areas where non-native plants have been introduced. Herbicide treatments in accordance with the alternatives would have relatively short-lived impacts; effects on non-target species would be minimized; such effects would not be permanent. No adverse impacts on roadless areas or degradation of roadless area quality would occur.

3.11.2 Long-term Productivity

Soils would be protected in this project and no loss of long-term productivity is predicted. The no-action alternative could have negative impacts on long-term productivity if invasive plants become so dense as to change soil characteristics, and capacity for restoration to desirable plant communities is lost.

The natural resources issues associated with this project have been resolved through adherence to project design feature (pdfs) that reduce or eliminate the potential for adverse effects. However, some adverse effects are inherent to invasive plant treatments and cannot be avoided. These include:

- Taxpayers will likely be responsible for the costs of some if not all of the treatments.
- Herbicide toxicity exceeding thresholds of concern are unlikely, but possible in the event of a large herbicide spill. The pdfs make the potential for a large spill extremely unlikely.
- Minor to moderate physical injuries during forestry work are possible.
- There may be temporary local effects on some groups of soil micro-organisms that are sensitive to certain herbicides. However, the pdfs address the potential for long-term impact to soil organisms or productivity.
- Some common non-target plants are likely to be killed by their close proximity to treatments. This is most likely with broadcast herbicide treatments and less likely (but possible) for all other treatment methods. The adverse effects of the invasive plants themselves far outweigh the potential for adverse effects of treatment.

3.11.3 Energy Requirements and Conservation Potential

No unusual energy requirements are associated with this project. No unusual equipment would be used.

3.11.4 Non-significant Land and Resource Management Plan (LRMP) Amendment

An amendment to the Malheur National Forest LRMP is proposed in Alternatives B and C in order to allow the use of aminopyralid. This is a non-significant amendment based on the National Forest Management Act implementing regulation. It would add one word to the existing standard 16 from the R6 2005 ROD that approved use of ten other herbicides. The risk assessment for aminopyralid was completed after a decision was made on the R6 2005 ROD.

The Forest Service Land and Resource Management Planning Manual (Forest Service Manual 1926.51) lists the changes to the land management plan that are not significant can result from:

1. Actions that do not significantly alter the multiple-use goals and objectives for long-term land and resource management.
2. Adjustments of management area boundaries or management prescriptions resulting from further on-site analysis when the adjustments do not cause significant changes in the multiple-use goals and objectives for long-term land and resource management.
3. Minor changes in standards and guidelines
4. Opportunities for additional projects or activities that will contribute to achievement of the management prescription.

Multiple Use Goals and Objectives

The proposed LRMP amendment does not affect multiple use goals and objectives and is intended to help the Forest Service achieve these goals on the Malheur National Forest.

Management Areas

The proposed amendment does not affect the boundaries or management direction for any management areas outlined in the LRMP.

Standards and Guidelines

The proposed LRMP amendment would approve us of an herbicide, aminopyralid, that is not currently listed among the ten approved by the Regional Forester in 2005 (R6 2005 ROD). The Risk Assessment (SERA 2007) for aminopyralid demonstrates that use of this herbicide would not pose new or significant risks compared to the ten already approved. Table 18 (chapter 3.2) shows a comparison between aminopyralid and the herbicides already approved. Aminopyralid is generally a lower risk herbicide and the proposed use would pose additional risks to human health or the environment.

Additional Project Opportunities

The proposed LRMP amendment would allow more effective and efficient treatment of invasive plants by adding aminopyralid, an herbicide that is very effective most of the invasive species found in the project area. It was developed specifically for wildland use and is effective at low rates. It requires less restrictions than most of the other herbicides already approved in the LRMP (for instance it can be broadcast sprayed to the water's edge, which would improve treatment effectiveness and efficiency relative to other herbicides).

Regardless of whether or not a non-significant amendment is approved, all alternatives would follow the management direction in the Malheur National Forest LRMP and comply with the National Forest Management Act.

3.11.5 Floodplains and Wetlands

Floodplains and wetlands would not be adversely affected by this project. As discussed in chapters 3.4, adverse effects to water quality and the beneficial uses of water would be negligible. The extent of treatment and potential for water contamination is low, and all alternatives are designed to protect water resources on the Malheur National Forest.

3.11.6 Prime Farmlands

No prime farmlands would be adversely affected by this project. There could be a beneficial impact to the extent that the alternatives reduce the potential for invasive plant spread from the Malheur National Forest to prime farmlands.

Chapter 4. Consultation and Coordination

List of Preparers and Consultation

Archer, Vince – Soils Scientist

Bautista, Shawna – Pesticide Use Coordinator; Herbicide Toxicology Analyst

Brooks, Paula J – Botanist

Carsey, Kathy S – Invasive Plant Specialist; Range Specialist

Desser, Rochelle - Interdisciplinary Team Leader; Treatment Cost-effectiveness Analyst

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Moser, Eric - Hydrologist

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Reitz, Scott – Wildlife Biologist

Schultz, Janice N – Writer/Editor

St. John, Rob – Recreation Specialist

A variety of specialists and managers from the Malheur National Forest and the Pacific Northwest Regional Office contributed information and reviewed an internal draft of the Draft Environmental Impact Statement. Local invasive plant management information was obtained from Oregon State Department of Agriculture and local county invasive plant management staff. Consultation is ongoing with Native American Indian tribes including the Confederated Tribes of the Warm Springs, the Confederated Tribes of the Umatilla Indian Reservation, and the Burns Paiute Tribe; the United States Fish and Wildlife Service; and the National Marine Fisheries Service. Several individuals and interest groups submitted comments during scoping periods in 2006 and 2011 (see chapter 1).

List of People to Whom This EIS has been Sent

Agencies and members of the public expressing interest in the project all received notice that the Draft EIS is available on request and on the web http://www.fs.fed.us/nepa/nepa_project_exp.php?project=35614 for comment. Hard copies or CD-ROM versions of the document were mailed directly to:

Individuals

B. Sachau
M. Greg Smith
Matt Carter
Walt Gentis
Dick Artley
John D. George

Organizations, Industry, and Local Agencies

Executive Director	Northwest Coalition for Alternatives to Pesticides
Doug Heiken	Oregon Wild
Kristin Ruether	Oregon Natural Desert Association
Phil Turrell	Rocky Mountain Elk Foundation, Harney County Chapter
Harold Shepard	Center for Tribal Water Advocacy
Oregon Eastside Forest Committee	Juniper Group Sierra Club
Dan Bishop	Prairie Wood Products
	John Day, Snake Resource Advisory Committee
Karen Coulter	League of Wilderness Defenders, Blue Mountains Biodiversity Project
Jason Kehrberg	Grant Soil and Water Conservation District

Oregon State Agencies

Oregon Department of Fish and Wildlife

Tribal Contacts

Honorable Les Minthorn	Confederated Tribes of the Umatilla Indian Reservation
Honorable Diane Teeman	Burns Paiute Tribe
Honorable Ron Suppah	Confederated Tribes of Warm Springs
Honorable Stanley ‘Buck’ Smith	Confederated Tribes of Warm Springs

Federal Agencies

Director, Planning and Review Advisory Council on Historic Preservation
Acquisitions and Serials Branch National Agriculture Library
Chief of Naval Operations (N45) Energy and Environmental Readiness Division
Northwest Power Planning Council
Deputy Director APHIS PPD/EAD
Habitat Conservation Division, NOAA Fisheries Service NW Region
U.S. Environmental Protection Agency, Region 10, EIS Review Coordinator
U.S. Coast Guard, Commandant CG-47, Department of Homeland Security
Director, NEPA Policy and Compliance, Department of Energy
U.S. Fish and Wildlife Service

Local Officials

Judge Steve Grasty	Harney County Court
Judge Scott Meyers	Grant County Court

References

Allison, S.D. and P.M. Vitousek. 2004 Rapid nutrient cycling in leaf litter from invasive plants in Hawaii. Oceologia 141:612-619.

Altman, B. 2000. Conservation strategy for landbirds in the northern Rocky Mountains of eastern Oregon and Washington. Version 1.0. May. Oregon-Washington Partners in Flight. 121pp.

Altman, R and A Holmes 2000. Conservation Strategies for Landbirds in the Columbia Plateau of Eastern Oregon and Washington. 131 pp.

Anderson, J.J. and J.J. Dulka. 1985. Environmental fate of sulfometuron methyl in aerobic soils. J. Agric. Food Chem. 33: 596-602

Archer, A. J. 2001. Taeniatherum caput-medusae [Online]. Available: http://www.fs.fed.us/database/feis. [Accessed Aug 11, 2003].

Arora, David. 1986. Mushrooms Demystified. A comprehensive guide to the fleshy fungi. Second edition. Ten speed press, 1986.

Asher , J. 2000. War on weeds: winnig it for wildlife. Paper presented at North American Wildlife and Naturall Resources conference. Rosemont, Illinois. March 27. 17 pp.

Aubry, K.B., G.M. Koehler, J.R. Squires. 2000. Ecology of Canada lynx in southern boreal forests. Pages 373-369. In Ruggiero, Leonard F.; Aubry, Keith B.; Buskirk, Steven W.; Koehler, Gary M.; Krebs, Charles J.; McKelvey, Kevin S.; Squires, John R. 1999. Ecology and conservation of lynx in the United States. General Technical Report RMRS-GTR-30WWW. Fort Collins, CO: United States Department of Agriculture, Forest Service, Rocky Mountain Research Station. Available at: http://www.fs.fed.us/rm/pubs/rmrs_gtr030.html

Audobon 2013. White-headed Woodpecker. Available at: http://www.audubon.org/. Accessed 5/23/2013.

Bakke, D. 2001. A Review and Assessment of the Results of Water Monitoring for Herbicide Residues for the Years 1991 to 1999, Unpublished report by the Forest Service Pacific Southwest Regional Pesticide Use Specialist.

Bakke, David. 2002. Analysis of issues surrounding the use of spray adjuvants with herbicides. Unpublished report by the Forest Service Pacific Southwest Regional Pesticide Use Specialist.

Bakke, David. 2003. Human and Ecological Risk Assessment of Nonylphenol Polyethoxylate-based (NPE) Surfactants in Forest Service Herbicide Applications. Unpublished report by the Forest Service Pacific Southwest Regional Pesticide Use Specialist.

Banci, V.A. 1994. Fisher (Pages 44 and 47) and Wolverine (Pages 99-127). In L.F. Ruggiero, K.B. Aubry, S.W. Buskirk, L.J. Lyon, and W.J. Zielinski, eds. 1994. The scientific basis for conserving forest carnivores, American marten, fisher, lynx and wolverine in the western United States. United States Department of Agriculture For. Serv. Rocky Mt. For. and Range Exp. Stn., Gen. Tech. Rep. RM-254, Fort Collins, CO.

Barrows, C. W. 1996. Tamarisk control and common sense. In: Proceedings of the California Exotic Pest Plant Council; October 4-6; San Diego, CA.

Bashkin, M., T.J. Stohlgren, Y. Otsuki, m. Lee, P. Evangelista, and J. Belnap. 2003. Soil characteristics and plant exotic species invasions in the Grand Staircase-Escalante national Monument, Utah, USA. Applied Soil Ecology. 22(1): 67-77

Bautista, S. 2008. Climate Change and Invasive Plants: Information for PNW Invasive Plant NEPA. Unpublished report.

Bautista, S.L., and S.P. Bulkin. 2008. Herbicide Information Summary and Project Design Criteria Crosswalk. Forest Service Unpublished Internal Report. United States Department of Agriculture Forest Service, Region 6. Portland, OR. 36p.

Beck. 2008. Diffuse and Spotted Knapweed. Colorado State Extension Service. Fact Sheet 3.111.

Bedunah, D.; Carpenter, J. 1989. Plant community response following spotted knapweed (Centaurea maculosa) control on three elk winter ranges in western Montana. 1998 Knapweed Symposium; Bozeman, MT.: Plant & Soil Department and Extension Service, Montana State University.

Benefield, C.B., J. DiTomaso, G.B. Kyser, S. Orloff, K.R. Churches, D.B. Marcum and G.A. Nader. 1999. Success of mowing to control yellow starthistle depends on timing and plant's branching form. California Agriculture 53:17-21. Available online at: http://californiaagriculture.ucanr.org/landingpage.cfm?article=ca.v053n02p17&fulltext=yes

Berg, N. 2004. Unpublished. Assessment of Herbicide Best Management Practices: Status of Our Knowledge of BMP Effectiveness. Pacific Southwest Research Station, United States Department of Agriculture Forest Service, Albany CA.

Berrill, M., S., Bertram, and B., Pauli. 1997. Effects of Pesticides on Amphibian Embryos and Larvae. Herpetological Conservation 1: p.233-45.

Berrill, M., S., Bertram, L., McGillivray, M., Kolohon, and B., Pauli . 1994. Effects of low concentrations of forest-use pesticides on frog embryos and tadpoles. Environmental Toxicology and Chemistry 13(4): p.657-64.

Blossey, B. 1999. Before, during, and after: the need for long-term monitoring in invasive plant species management. Biological Invasions 1:301-311. - Deschutes

Blus, L.J., C.S. Staley, C.J. Henny, G.W. Pendleton, T.H. Craig, E.H. Craig, and K.K. Halford. 1989. Effects of organophosphorus insecticides on sage grouse in southeastern Idaho. Journal of Wildlife Management 53: 1139-1146.

Bollag, J.M., and S.Y. Liu. 1990. Biological Transformation Processes of Pesticides. In Pesticides in the Soil Environment. H.H. Cheng. (ed.) Soil Science Society of America book series, no. 2. Madison, Wis., USA: Soil Science Society of America. p. 169-211

Bramble, W.C., R.H. Yahner, and W.R. Byrnes. 1997. Effect of herbicides on butterfly populations of an electric transmission right-of-way. Journal of Arboriculture 23(5) 11 pp.

Braun, C.E. 1987. Current issues in sage grouse management. Proceedings of the Western Association of Fish and Wildlife Agencies 67: 134-144.

Braun, C.E. 1998. Sage grouse declines in western North America: what are the problems? Proceedings of the Western Association of Fish and Wildlife Agencies 78: 139-156.

Bridges, C.M. & Semlitsch, R.D. (2000) Variation in pesticide tolerance of tadpoles among and within species of Ranidae and patterns of amphibian decline. Conservation Biology 14: 1490-1499.

Bridsall, J.L., W. McCaughey and J.B. Runyon. 2011. Roads impact the duistribution of noxious weeds more than restoration treatments in a lodgepole pine forest in Montana, United StatesA. Restoration Ecology: 1-7.

Brooks, H.C. 1979. Plate Tectonics and Geologic History of Blue Mountains. Oregon Geology, Volume 41, Number 5.

Brotherson, J. D.; Field, D. 1987. Tamarix: impacts of a successful weed. Rangelands. 9: 110-112.

Brown, C.E. and T.P. Thayer. 1966. The Geologic Map of the Canyon City Quadrangle, Oregon. USGS Miscellaneous Geologic Investigations Map I-447.

Brown, M.L., Duncan, C.A., and Halstvedt, M.B. 2001. Cost and efficacy of spotted knapweed management and with integrated methods. Techline (May): p. 2-5.

Bull, E.L. and M.P. Hayes. 2001. Post-breeding season movements of Columbia spotted frogs (Rana luteiventris) in northeastern Oregon. Western North American Naturalist 61(1): 119-123. – Deschutes EIS

Bull, Evelyn L. 1980. Resource partitioning among woodpeckers in northeastern Oregon. Ph.D. Dissertation, Univ. Idaho, Moscow. 109 pp. In Mellen-McLean, Kim 2012d. MIS Information Sheet. Primary Cavity Nesters/Excavators. 29 pp.

Bullock, J.M. and R.T. Clarke. 2000. Long distance seed dispersal by wind: measuring and modeling the tail of the curve. Oecologia 124:506-521.

Buonopane, M., G. Snider, B.K. Kerns, and P.S. Doescher. 2013. Complex restoration challenges: weeds, seeds, and roads in a forested Wildland Urban Interface. Forest Ecology and Management. 295: 87-96

Busse, M.D., A.W. Ratcliff, C.J. Shestak, and R.F. Powers. 2001. Glyphosate toxicity and the effects of long-term vegetation control on soil microbial communities. Soil Biology & Biochemistry (33) 1777-1789.Callaway, R., G.C. Thelen, A. Rodriguez, and W.E. Holben. 2004. Soil biota and exotic plant invasion. Nature. 427: 431-433

Carlson, G. 1974. Malheur National Forest Soil Resource Inventory. Unpublished In-Service Report. United States Department of Agriculture Forest Service, Pacific Northwest Region, Malheur National Forest. John Day, OR. 137p.

Castelle, A.J., A.W. Johnson, and C. Conolly. 1994. Wetland and Stream Buffer Size Requirements—A Review. Journal of Environmental Quality 23:878-882

Castelle, A.J., And A.W. Johnson. 2000. Riparian Vegetation Effectiveness. National Council for Air and Stream Improvement. Technical Bulletin 799.

Cattle, S. I. Cousin, F. Darboux and Y. Le Bissonnais. The Effect of Soil Crust ageing, Through Wetting and Drying, on Some Surface Structural Properties. SuperSoil 2004: 3rd Australian New Zealand Soils Conference, 5-9 December 2004, University of Sydney Australia. www.regional .org.au/au/asssi/

Cerdan, O., V. Souchere, V. Lecomte, A. Couturier, and Y. Le Bissonnais. 2001. Incorporating Soil Surface Crusting Process in an Expert-Based Runoff Model: Sealing and Transfer by Runoff and Erosion Related to Agricultural Management. Catena 46 189-205.

Chew, F. S. 1981. Coexistence and local extinction in two Pieris butterflies. American Naturalist. 118: 655-672.

Clements, J. F., T. S. Schulenberg, M. J. Iliff, B.L. Sullivan, C. L. Wood, and D. Roberson. 2012. The eBird/Clements checklist of birds of the world: Version 6.7. Downloaded from http://www.birds.cornell.edu/clementschecklist/downloadable-clements-checklist. Accessed 4/22/2013.

Cole, E.C., W. C. McComb, M. Newton, , C.L. Chambers and J.P. Leeming. 1997. Response of amphibians to clearcutting, burning, and glyphosate application in the Oregon Coast Range. Journal of Wildlife Management. 61:p.656-64.

Cole, E.C., W. C. McComb, M. Newton, J.P. Leeming, and C.L. Chambers. 1998. Response of small mammals to clearcutting, burning, and glyphosate application in the Oregon Coast Range. Journal of Wildlife Management. 62(4): p. 1207-16.

Colorado Weed Management Associations (CWMA) 2007. Diffuse knapweed. http://www.cwma.org/nx_plants/diff.htm

Connelly J.W., H.W. Browers, R.J. Gates. 1988. Seasonal movements of sage grouse in southeastern Idaho. J. Wildl. Manage. 52:116–122.

Connelly, J. W., JR. 1982. An ecological study of sage grouse in southeastern Idaho. Dissertation, Washington State University, Pullman, USA.

Connelly, J. W., M. A. Schroeder, A. R. Sands, C. E. Braun. 2000. Guidelines to manage sage grouse populations and their habitats. Wildlife Society Bulletin 28(4): 967-985.

Connelly, J.W. and O.D. Markham. 1983. Movements and radio nuclide concentrations of sage grouse in southeastern Idaho. Journal of Wildlife Management 47:169-177.

Connelly, J.W.; M.A. Schroeder; A.R. Sands; and C.E. Braun. 1991. Sage grouse use of nest sites in southeastern Idaho. Journal of Wildlife Management 55: 521-524.

Copeland, J.P. 1996. Biology of the Wolverine in Central Idaho. Master’s Thesis. 152 pp.

Corkran, C. C., and C. R. Thoms. 2006. Amphibians of Oregon, Washington, and British Columbia. Lone Pine Publishing, Auburn, WA.

Crawford, J.A.; R.A. Olson; N.E. West; J.C. Mosley; M.A. Schroeder; T.D. Whitson; R.F. Miller; M.A. Gregg; and C.S. Boyd. 2004. Ecology and management of sage-grouse and sage-grouse habitat. Journal of Range Management 57: 2-19.

Csuti, B., A. J. Kimerling, T. A. O’Neil, M. M. Shaughnessy, E. P. Gaines, and J. C. Hak 2001. Atlas of Oregon wildlife: distribution, habitat, and natural history. Oregon State University Press, Corvallis, OR. 492 pp.

Dabbert, C.B., R.B. Mitchell, and D. Oberheu. 1997. Northern bobwhite egg hatchability and chick immunocompetence following field application of clopyralid. Bulletin of Environmental Contamination and Toxicology. 58: 801-806

Daly, M. Halbleib, J.I. Smith, W.P. Gibson, M.K. Doggett, G.H. Taylor, J. Curtis, and P.P. Pasteris. 2008. Physiographically sensitive mapping of climatological temperature and precipitation across the conterminous United States. International Journal of Climatology. 34p.

D'Antonio, C. M.; Vitousek, P. 1992. Biological invasions by exotic grasses, the grass/fire cycle, and global change. Annual Review of Ecological Systems. 23: 63-87.

Dassonville, N., S. Vanderhoeven, V. Vanparys, M. Hayez, W. Gruber, and P. Meerts. 2008. Impacts of alien invasive plants on soil nutrients are correlated with initial site conditions in NW Europe. Oecologia. 157(1) : 131-140

Davidson, E.A., E. Belk, and R.D. Boone. 1998. Soil water content and temperature as independent or confounded factors controlling soil respiration in a temperate mixed hardwood forest. Global Change Biology. 4: 217-227.

Dechant, J.A., M.F. Dinkins, D.H. Johnson, L.D. Igl, C.M. Goldade. B.D. Parkin, and B.R. Euliss. 2002b. Effects of management practices on grassland birds.: Upland Sandpiper. Northern Prairie Wildlife Research Center, Jamestown, ND. 34 pp.

Dechant, J.A., M.L. Sondreal, D.H. Johnson, L.D. Igl, C.M. Goldade, M.P. Nenneman, and B.R. Euliss. 2002a. Effects of management practices on grassland birds: Grasshopper Sparrow. Northern Prairie Wild Research Center, Jamestown, ND. 28 pp.

Dechant, J.A., M.L.Sondreal, D.H.Johnson, L.D.Igl, C.M. Goldae, A.L. Zimmerman, and B.R. Euliss. 1999. (revised 2001). Effects of management practices on grassland birds: Bobolink. Northern Prairie Wildlife Research Center, Jamestown, ND 24 pp.

Deixis MolluscDB database. 2009. Unpublished collection of mollusk records maintained by Ed Johannes. In United States Department of Agriculture Forest Service. 2013. Species Fact Sheet. Harney Basin Duskysnail (Colligurus depressus). 17 pp.

Desser, Rochelle. 2007. Rationale for 80% annual effectiveness estimate in cost analysis for invasive plant projects. Unpublished report by the R6 Invasive Plant NEPA and Monitoring Coordintaor.

Desser, Rochelle. 2008. Source and Effectiveness of Project Design Features/Criteria for Herbicide Use in Invasive Plant Treatment Projects Forest Service Region Six

Desser, Rochelle. 2012. Declaration NRS-#934106-v2-Desser for Case No. CV-10-1397-SI

DiTomaso 2001 – herbicide tolerant plant species selection – add to “repeated spraying discussion

DiTomaso, J.M. 1999. Prescribed burning for control of yellow starthistle (Centaurea solstitialis) and enhanced native plant diversity. Weed Science 47: 233 – 242.

DiTomaso, J.M. 2000. Invasive plants in rangelands: Species, impacts, and management. Weed Science 48: 255-265.

Dixon, R. D. and V. A. Saab. 2000. Black-backed woodpeckers. In The birds of North America. ed. Poole, A. and F. Gill, Cornell, New York: Cornell Laboratory of Ornithology and the Academy of Natural Science.

Dooley, S. and J. Beckstead. 2010. Characterizing the interaction between a fungal seed pathogen and a deleterious rhizobacterium for biological control of cheatgrass, Biological Control. 53: 197-203

Dudley, T. L. 2000. Noxious wildland weeds of California: Arundo Donax. In: Bossard, C. C.; Randall, J. M.; Hoshousky, M. C., eds. Invasive plants of California wildlands. Berkeley, CA: Univ. of California Press: 53-58.

Durkin and Durkin, 2005. A Note on Plausible Initial Pesticide Residues on Selected Mushrooms: Hen of the Wood, Shiitake, and Portabello. Unpublished Internal Forest Service review of residues on mushrooms and associated health risks.

Ehrenfeld, J.G. 2003. Effects of exotic plant invasions on soil nutrient cycling processes. Ecosystems 6: 503-523.

Ehrenfeld, J.G., P. Kourtev, and W. Huang. 2001. Changes in soil functions following invasions of exotic understory plants in deciduous forests. Ecological Applications 11(5) 1287-1300.

Ehrenfield, J.G. 2003. Effects of exotic plant invasions on soil nutrient cycling processes. Ecosystems. 6: 503-521Eviner and Firestone 2007

Elliot, W.J. 2004. WEPP internet interfaces for forest erosion prediction. Journal of the American Water

Erickson 2006. Personal communication, effectiveness of manual and mechanical treatments on the Umatilla National Forest

Erickson, Vicky, Scott Wood and Jean A Riley. 2003. Draft Guidelines for Revegetation of Invasive plant Sites and Other Disturbed Areas on National Forests and Grasslands in the Pacific Northwest. Unpublished internal Forest Service document.

Esteves, M. X. Faucher, S. Galle, and M. Vauclin. 2000. Overland Flow and Infiltration Modeling for Small Plots During Unsteady Rain: Numerical Results Versus Observed Values. Journal of Hydrology 228 265-282.Fischer, R.A., and J.C. Fischenich, 2000. Design recommendations for riparian corridors and vegetated buffer strips. United States Army Engineer Research and Design Center. ERDC-TN-EMRRP-SR-24.

Fagerstone, K.A., H.P. Tietjen, and G..K. LaVoie. 1977. Effects of range treatment with 2,4-D on prairie dog diet. Journal of Range Management 30(1): 57-60.

Fieldler, C.E., E.K. Dodson, and K.L. Metlen. 2010. Invasive plant response to forest disturbance in the western United States. In: S. Jose and H.P. Singh, eds. Invasive Plant Ecology CRC Press, Boca Raton, FL. In review.

Fischer, R.A., and J.C. Fischenich, 2000. Design recommendations for riparian corridors and vegetated buffer strips. United States Army Engineer Research and Design Center. ERDC-TN-EMRRP-SR-24.

Fletcher, J.S., J.E. Nellessen, and T.G. Pfleeger. 1994. Literature review and evaluation of the EPA food-chain (Kenaga) nomogram, and instrument for estimating pesticide residue on plants. Environ. Toxicol. And Chemistry 13(9):p.1383-91.

Flory, S.L., and K. Clay. 2009. Effects of roads and forest successional age on experimental plant invasions. Biological Conservation. 142: 2531-2537

Ganapathy, C. 1997. Environmental Fate of Triclopyr. Environmental Monitoring and Pest Management Branch, Department of Pesticide Regulation, Sacramento California.

Gelbard, J.L. and J. Belnap. 2003. Roads as conduits for exotic plant invasions in a semiarid landscape. Conservation Biology 17: 420-432.

Germaine, S. S.; Rosenstock, S. S.; Schweinsburg, R. E; Richardson, W. S. August 1998. Relationships among breeding birds, habitat, and residential development in greater Tucson, Arizona. Ecological Applications. 8(3): 680-691.

Greene, R.C., G.W. Walker, and R.E. Corcoran. 1972. The Geologic Map of the Burns Quadrangle, Oregon. USGS Miscellaneous Geologic Investigations Map I-680.

Grismer, M.E., and M.P. Hogan. 2005. Simulated rainfall evaluation of revegetation /mulch erosion control in the lake tahoe basin: 2. Bare soil assessment. Land Degradation & Development. 16: 397-404

Gundale, M.J., S. Sutherland, and T.H. DeLuca. 2008. Fire, native species, and soil resource interactions influence the spatio-temporal invasion pattern of *Bromus tectorum*. Ecography. 31: 201-210

Guo, D., P. Mou, R.H. Jones, and R.J. Mitchell. 2004. Spatio-temporal patterns of soil available nutreints following experimental disturbance in a pine forest. Oecologia. 138: 613-621

Hansen, M.J. and A.P. Clevenger. 2005. The influence of disturbance and habitat on the presence of non-native plant species along transport corridors. Biological Conservation 125:249-259.

Hanula, J.L. and S. Horn. 2011. Removing an exotic shrub from riparian forests increases butterfly abundance and diversity. Forest Ecology and Management 262:674-680.

Hart, S. C., T. H. DeLuca, G. S. Newman, M. D. MacKenzie, and S. Boyle. 2005. Post-fire vegetative dynamics as drivers of microbial community structure and function in forest soils. Forest Ecology Manual. 230: 166-184

Hatler, D.F. 1989. A Wolverine Management Strategy for British Columbia. Wildlife Bulletin No. B-60. May 1989. Prepared for Ministry of Environment. 140 pp.

Hawkes, C.V., I.F. Wren, D.J. Herman, and M.K. Firestone. 2005. Plant invasion alters nitrogen cycling by modifying the soil nitrifying community. Ecology Letters. 8: 976-985

Hayes, Marc, J.D. Engler, , R.D. Haycock, D.H. Knopp, W.P. Leonard, K.R. McAllister, and L.L. Todd. 1997. Status of the Oregon spotted frog (Rana pretiosa) across its geographical range. In The Spotted Frog of Oregon. Oregon Chapter of The Wildlife Society, Corvallis, OR. August 15.

Heady, L.T. and J.W. Laundre 2005. Habitat use patterns within the home range of pygmy rabbits (Brachylagus idahoensis) in southeastern Idaho. North American Naturalist, Vol. 65, No. 4. pp. 490-500.

Henny, C.J., W.S. Seegar, and T.L. Maechtle. 1996. DDT decreases inplasma of spring migrant peregrine falcons, 1978-1994. J. Wildl. Manage. 60: 342-349.

Holmes, A.L. and R.F. Miller 2010. State and Transition Models for Accessing Grasshopper Sparrow Habitat Use. Journal of Wildlife Management. 74(8): 1834-1840.

Hornocker, Maurine G. and Howard S. Hash. 1981. Ecology of the wolverine in northwestern Montana. Canadian Journal of Zoology 59, (September 1980): 1286-1301.

Horton, J. S. 1977. The development and perpetuation of the permanent tamarisk type in the phreatophyte zone of the southwest. Gen. Tech. Rep. 43. United States Department of Agriculture, Forest Service, Rocky Mountain Forestry and Range Experiment Station. p. 124-127.

Houston, A.P.C., S. Visser, and R.A. Lautenschlager. Response of microbial processes and funal community structure to vegetation management in mixedwood forest soils. Canadian Journal of Botany. 76: 2002-2010

Hutto, Richard L. 1995. Composition of bird communities following stand-replacement fires in northern Rocky Mountain (United StatesA.) conifer forests. Conservation Biology 9, 1041–58.

Inman, R.M., K.H. Inman, A.J. McCue, and M.L. Packila. 2007. Wolverine harvest in Montana: survival rates and spatial considerations for harvest management. Pages 85-96 in Wildlife Conservation Society. Greater Yellowstone Wolverine Program, Cumulative Report, May 2007. Ennis, MT.

Jakle, M. D.; Gatz, T. A. 1985. Herpetofaunal use of four habitats of the middle Gila River drainage, Arizona. Paper Presented at the North American Riparian Conference; April 16-18, 1985; Tucson, AZ.

James, J.J., B.S. Smith. E.A. Vasquez, and R.L. Sheley. 2010. Principles for ecologically based invasive plant management. Invasive Plant Science and Management. 3: 229-239

Janes, S.W. 1983. Status. Distribution, and Habitat Selection of the Grasshopper Sparrow in Morrow County, Oregon. The Murrelet, Vol 64, No 2. pp. 51-54.

Janzen, D. 1984. Dispersal of Small Seeds by Big Herbivores: Foliage is the Fruit

Jepsen, S., LaBar, C., Zarnoch, J. 2010. *Gonidea angulata* (Lea, 1838) Western ridged mussel Bivalvia: Unionidae. Xerces Society for Invertebrate Conservation. 19 pps.

Johnson, D. H., and T. A. O'Neil, Managing Directors. 2001. Wildlife-habitat relationships in Oregon and Washington. Oregon State University Press, Corvallis, OR. 736 pp. In Mellen-McLean, Kim 2012d. MIS Information Sheet. Primary Cavity Nesters/Excavators. 29 pp.

Johnson, D.R., and Hansen, R.M. 1969. Effects of range treatment with 2,4-D on rodent populations. Journal of Wildlife Management 33: 1125-132.

Johnson, M. L. 1995. Reptiles in the state of Washington (1954). Northwest Fauna 3:5-80. The Society of Northwestern Vertebrate Biology, Olympia, WA.

Kenaga, E.E. 1973. Factors to be considered in the evaluation of the toxicity of pesticides to birds in their environment. In: Environmental Quality and Safety: Global Aspects of Chemistry, Toxicology and Technology as Applied to the Environment. Vol. II. New York, NY: George Thieme Publishers, Stutgart Academic Press, Inc.

Kiviat, E. 1996. Short communications: American goldfinch nests in purple loosestrife. Wilson Bulletin. 108(1): 182-186.

Korb, J.E., N.C. Johnson, and W.W. Covington. 2004. Slash pile burning effects on soil biotic and chemical protperies and plant establishment: recommendations for amelioration. Restoration Ecology. 12(1): 52-62

Kulmatiski, A., K.H. Beard, J.R. Stevens, and S.M. Cobbold. 2008. Plant-soil feedbacks: a meta-analytical review. Ecology Letters. 11: 980-992

Lacey J. R., R. Wallender, and K. Olson-Rutz. 1992. Recovery, germinability, and viability of leafy spurge (Euphorbia esula) seeds ingested by sheep and goats. Weed Technol. 6:559–602.

Lacey, J. R., Olson, B. E. 1991. Environmental and economic impacts of noxious range weeds. In: James, L. F.; Evans, J. O.; Ralphs, M. H.; Child, R. D., eds. Noxious range weeds. Boulder, CO: Westview Press

Lacey, R.C., C.B. Marlow and J.R. Lane. 1989. Influence of spotted knapweed (Centaurea maculosa) on surface runoff and sediment yield. Weed Technology (3) 627-631.

Lauenroth, W.K., D.G. Milchunas, J.L. Dodd, R.H. Hart, R.K. Heitschmidt, and L.R. Rittenhouse. 1994 . Effects of grazing on ecosystems of the Great Plains . Pages 69 - 100 in Vavra, M., W.A. Laycock, and R.D. Pieper Editor(s). Ecological implications of livestock herbivory in the West. Society for Range Management, Denver, CO.

Laufman, J. 2007. Umatilla National Forest Invasive Plants Treatment Project, Botany Report and Biological Evaluation.

Lefcort, H., R. A. Meguire, L. H. Wilson, W. F. Ettinger. 1998. Heavy metals alter the survival, growth, metamorphosis, and antipredatory behavior of Columbia spotted frog (Rana luteiventris) tadpoles. Archives of Environmental Contamination and Toxicology 15:447–456.

Lejeune, K. and T. Seastedt (2001). "*Centaurea* Species: the Forb That Won the West." Conservation Biology 15(6): 1568-1574.

Leonard, Jr., David L. 2001. American Three-toed Woodpecker (Picoides dorsalis), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/588doi:10.2173/bna.588

Lloyd, R.A., K.A. Lohse, and TPA Ferré. Influence of road reclamation techniques on forest ecosystem recovery. Front. Ecol. Environ. 11(2): 75-81

Lor, S.K. 2000. Habitat use and population status of marsh birds in western New York. Ithaca, NY: Department of Natural Resources, Cornell University. 135 p. Thesis.

Mack, R. N. 1981. Invasion of Bromus tectorum L. into western North America: an ecological chronicle. Agro-Ecosystems. 7: 145-165.

Magoun, A.J. and J.P. Copeland. 1998. Characteristics of Wolverine Reproductive Den Sites. Journal of Wildlife Management. 62(4): 1313-1320.

Marco, A., C. Quilchano, and A. R. Blaustein. 1999. Sensitivity to nitrate and nitrite in pond breeding amphibians from the Pacific Northwest, USA. Environmental Toxicology and Chemistry 18:2836–2839.

Marrs, R., C. Williams, A. Frost, and R. Plant. 1989. Assessment of the effects of herbicide spray drift on a range of plant species of conservation interest. Environmental Pollution. 59: 71-86.

Marshall, D. B., M. G. Hunter, and A. L. Contreras, Eds. 2003. Birds of Oregon: a general reference. Oregon State University Press, Corvallis, OR. 768 pp.

Marshall, J.S., and L.W. Vandruff. 2002. Impact of Selective Herbicide Right-of-Way Vegetation on Birds. Environmental Management 30(6): p. 801-6.

Maser, Chris; Mate, Bruce R.; Franklin, Jerry F.; Dyrness, C. T. 1981. Natural history of Oregon coast mammals. Gen. Tech. Rep. PNW-133. Portland, OR.: United States Department of Agriculture Forest Service, Pacific Northwest Range and Experiment Station. 496 p.

Mazzacano, C. 2008. Fisherola nuttalli (Haldeman 1841) Giant Columbia River limpet; shortface lanx Gastropoda: Lymnaeidae. Xerces Society for Invertebrate Conservation. 5 pps.

McAdoo, J.K.; S.R. Swanson; B.W. Schultz; and P.F. Brussard. 2004. Vegetation management for sagebrush-associated wildlife species. P. 189-193 in United States Department of Agriculture Forest Service Proceedings RMRS-P-31. – Deschutes Weed eis

McAllister, K. R., and W. P. Leonard. 1997. Washington state status report for the Oregon Spotted Frog. Washington

McGrath, Michael T., Stephen DeStefano, Robert A. Riggs, Larry L. Irwin, and Gary J. Roloff. 2003. Spatially explicit influences on northern goshawk nesting habit in the Interior Pacific Northwest. Wildlife Monographs 154, 1–63. In Samson, Fred B. 2006a. A conservation assessment of the northern goshawk, black-backed woodpeckers, flammulated owl, and pileated woodpecker in the Northern Region. United States Department of Agriculture, Forest Service.

McKelvey, K.S., K.B. Aubry, and Y.K. Ortega. 2000 History and distribution of lynx in the contiguous United States. Pages 207-264 In Ruggiero, L.F., K.B. Aubry, S.W. Buskirk, G.M. Koehler, C.J. Krebs, K.S. McKelvey, and J.R. Squires. (Tech. Eds). 1999. Ecology and conservation lf lynx in the United States. Univ. Press of Colorado. Boulder, Co. 480 pp.

McMurray, S.T., R.L. Lochmiller, J.F. Boggs, D.M. Leslie Jr., Engle and others. 1993a. Woodrat Population Dynamics Following Modification of Resource Availability. American Midland Naturalist (129): p. 48-56.

McMurray, S.T., R.L. Lochmiller, J.F. Boggs, D.M. Leslie Jr., Engle and others. 1993b. Opportunistic Foraging of Eastern Woodrats (Neotoma floridana) in Manipulated Habitats. American Midland Naturalist (130): p. 325-37..

Mellen-McLean, Kim 2012c. MIS Information Sheet. American Tree-toed Woodpecker (Picoides dorsalis), Three-toed Woodpecker (Picoides tridactylus) and Northern Three-toed Woodpecker (Picoides tridactylus dorsalis). 16 pp.

Mellen-McLean, Kim 2012d. MIS Information Sheet. Primary Cavity Nesters/Excavators. 29 pp.

Mellen-McLean, Kim, 2012b. MIS Information Sheet. American Marten (Martes Americana). 20 pp.

Mellen-McLean, Kim. 2012a. MIS Information Sheet. Pileated Woodpecker (Dryocopus pileatus). 18 pp.

Meyer, N. 2009. Soil and Plant Response to Slash Pile Burning in a Ponderosa Pine Forest. M.S. Thesis, Department of Land Resources and Environmental Sciences. Montana State University, MT. 98pp.

Mills, G.. S.; Dunning Jr., J. B.; Bates, J. M. 1989. Effects of urbanization on breeding bird community structure in Southwestern desert habitats. The Condor. (91): 416-28.

Moore, D.C. and M.J. Singer. 1990. Crust Formation on Soil Erosion Processes. Soil Sci. Soc. AM J., 54:1117-1123.

Morse, R.A. and N.W. Calderone. 2000. The value of honey bees as pollinators of United States crops in 2000. Bee Culture Magazine 128: 1-14.

Mosley JC, Bunting SC, Manoukian ME. 1999. Cheatgrass. In: Sheley RL, Petroff JK, editors. Biology and Management of Rangeland Weeds. Corvallis (OR): Oregon State University Press. p 175-188. In: http://www.fws.gov/invasives/stafftrainingmodule/methods/chemical/review.html. Accessed 5/26/13

NatureServe Explorer: An online encyclopedia of life [web application]. 2013. Version 1.6. Arlington, VA, USA: NatureServe. Available: http://www.natureserve.org/explorer/.

NatureServe. 2013. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: May 29, 2013).

Newmaster, S.G., F.W. Bell, and D.H. Vitt. 1999. The effects of glyphosate and triclopyr on common bryophytes in northwestern Ontario. Canadian Journal Forest Research 29: 1101-1111.

Nolte, K. R.; Fulbright, T. E. 1997. Plant, small mammal, and avian diversity following control of honey mesquite. Journal of Range Management. 50(2): 205-212.

Norton, J.B., T.A. Monaco, and U. Norton. Mediterranean annual grasses in western North America: kids in a candy store. Plant Soil. 1-5

Olson, B. E., 1999. Impacts of noxious weeds on ecologic and economic systems. Pages 4-18 in Biology and Management of Noxious rangeland weeds. R. L. Sheley and J. K. Petroff (Eds.). Oregon State University Press, Corvallis, Oregon.

Olson, B.E. 1999. Impacts of noxious weeds on ecologic and economic systems. In: Sheley, R.L.; Petroff, J.K., eds. Biology and management of noxious rangeland weeds. Corvallis, Oregon: Oregon State Univ. Press. p. 4-18.

Oregon Biodiversity. 2010. Rare, Threatened and Endangered Species of Oregon. Oregon Biodiversity Information Center. October 2010. 109 pp.

Oregon Department Of Environmental Quality. 2010. Water Pollution. Division 41. Water Quality Standards: Beneficial Uses, Policies, and Criteria For Oregon. 340-041-0001 to 0350

Oregon Department of Fish and Wildlife. 2005. Oregon Wolf Conservation and Management Plan. 116 pp.

Oregon Department of Fish and Wildlife. 2006. Oregon Conservation Strategy. Available at: http://www.dfw.state.or.us/conservationstrategy/read_the_strategy.asp. Accessed 4/15/2013.

Oregon Department of Fish and Wildlife. 2009. Richard W. Carmichael. Conservation and Recovery Plan for Oregon Steelhead Populations in the Middle Columbia River Steelhead Distinct Population Segment

Oregon Department of Fish and Wildlife. 2013. http://dfw.state.or.us/Wolves/population.asp (Accessed 04/10/2013)

Oregon State University. 2013. Oregon Explorer. Available at: http://oregonexplorer.info/wildlife/ThreatenedandEndangeredSpecies/DecliningandAt-Risk. Accessed 4/19/2013.

Ortega, Y.K., D.E. Pearson. 2005. Weak vs. strong invaders of natural plant communities: assessing invisibility and impact. Ecological Applications. 15(2): 651-661

Pacific Bioversity Institute. 2013. Columbia clubtail species profile. http://www.pacificbio.org/initiatives/ESIN/OtherInvertebrates/LynnsClubtail/LynnsClubtail_pg.html (Accessed: May 29, 2013).

Pagel, J. unpublished data. 2006. Peregrine falcon nest site data, 1983-2006 collected for PNW Interagency Peregrine Falcon Program, Ashland OR

Partners in Flight. 2000. Conservation Strategy for Landbirds in the Columbia Plateau of Eastern Oregon and Washington. Version 1.0. March 2000. 144 pp.

Pasitschniak, Arts, M., and S. Larivière. 1995. Gulo gulo, Mammalian Species. Amer. Soc. of Mammalogists, 499: 1-10.

Perkins, Peggy J., Boermans, Jerman H., Stephenson, Gerald R. 2000. Toxicity of Glyphosate and Triclopyr using the frog embryo. Teratogenesis Assay-Xenopus. Environmental Toxicol and Chemistry 19(4): p.940-5.

Peterson, David L. 2006. Biological Status Assessment and Petition to Remove the Peregrine Falcon from Oregon’s List of Endangered Species. Oregon Department of Fish and Wildlife Commission.

Pfleeger, T.G.., A. Fong, R. Hayes, H. Ratsch, and C. Wickliff. 1996. Field evaluation of the EPA (Kenaga) nomogram, a method for estimating wildlife exposure to pesticide residue on plants. Environmental Toxicology and Chemistry 15(4): p. 535-43.

Pyle, R.M. 2002. The Butterflies of Cascadia, A Field Guide to All the Species of Washington, Oregon, and Surrounding Territories. Seattle Audubon Society, Seattle, Washington. 420 pp. In United States Department of Agriculture Forest Service. 2011b. Species Fact Sheet. Johnson’s Hairstreak (Callophrys johnsoni). 8 pp.

Quigley, T.M., and S.J. Arbelbide. Tech Eds., 1997. An Assessment of Ecosystem Components in the Interior Columbia Basin and Portions of the Klamath and Great Basins. Gen. Tech. Rep. PNW-GTR-405. Portland, OR. United States Department of Agriculture, Forest Service, Pacific Northwest Research Station. Vol. 4.

Raloff, J. 1998. Botanical 'velcro' entraps hummingbirds- burrs cause bird fatalities. [Online]. Available: http://www.findarticles.com/p/articles/mi_m1200/is_n16_v154/ai_21250276. Accessed July 2004.

Randall, J.M. 1996. Weed control for the preservation of biological diversity. Weed Technology. 10: 370-383.

Ratcliff, A.W., M.D. Busse, and C.J. Shestak. 2006. Changes in microbial community structure following herbicide (Glyphosate) additions to forest soils. Applied Soil Ecology. 34: 114-124

Rawinski T. J. 1982. The ecology and management of purple loosestrife (Lythrum salicaria L.) in central New York. Ithaca, N.Y.: Cornell University, ix: 88.

Rawinski, T. J.; Malecki, R. A. 1984. Ecological relationships among purple loosestrife, cattail and wildlife at the Montezuma National Wildlife Refuge. New York Fish and Game Journal. 31(1): 81-87.

Reames, Clark, 2013a. Personal communication with Scott Reitz. Townsend's big-eared bat. documentation. March 6, 2013.

Reames, Clark. 2013b. Personal communication with Howard Richburg. Bald Eagle Nest Locations. May 22, 2013.

Rees, J. and P. Lee. 1990. Management of bald eagles, Haliaeetus leucocephalus, and their habitats on National Forests of the Pacific Northwest. United States Department of Agriculture Forest Service, Portland, OR. 61 pp. + appendices. – Deschutes EIS

Relyea, R.A. 2005. The impact of insecticides and herbicides on the biodiversity and productivity of aquatic communities. Ecological Applications 15(2): p. 618-27.

Reynolds, R. T., R. T. Graham, M. H. Reiser; and others. 1992. Management recommendations for the northern goshawk in the southwestern United States. General Technical Report RM-217. Ft. Collins, CO: United States Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 184 p.

Rice, P. 2000. Restoration of native plant communities infested by invasive weeds – Sawmill Creek Research Natural Area. United States Department of Agriculture Forest Service Proceedings RMRS-P-17: 29-30.

Rice, P. M.; Toney, C.; Bedunah, D. J.; Carlson, C. E. 1997. Plant community diversity and growth form responses to herbicide applications for control of Centaurea maculosa. Journal of Applied Ecology. 34: 1397-1412.

Rinella, M.J., B.D. Maxwell, P.K. Fay, T. Weaver, and R.L. Sheley. 2009. Contorl effort exacerbates invasive-species problem. Ecological Applications. 19(1): 155-162

Rosenshield, M.L., Jofre, M.B., and W.H. Karasov. 1999. Effects of polychlorinated biphenyl 126 on green frog (Rana clamitans) and leopard frog (Rana pipiens) hatching success, development, and metamorphosis. Environmental Toxicology and Chemistry 18:2478-2486.

Rowland, M.M, and Wisdom, M.J. 2002. Research problem analysis for Greater Sage-grouse in Oregon. Final Report. Oregon Department of Fish and Wildlife; United States Department of the Interior, Bureau of Land Management, Oregon/Washington State Office; and United States Department of Agriculture, Forest Service, Pacific Northwest Research Station: 75 p. – Deschutes EIS

Rowland, M.M., M.J. Wisdom, B.J. Johnson, and J.G. Kie. 2000. Elk distribution and modeling in relation to roads. J. Wildl. Manage. 64(3): 672-684.)

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. United States Department of Agriculture Forest Service, United States Department of the Interior Fish and Wildlife Service, United States Department of the Interior Bureau of Land Management, and United States Department of the Interior National Park Service. Forest Service Publication #R1-00-53, Missoula, MT. 142 pp. (http://www.fs.fed.us/r1/wildlife/carnivore)

Ruediger, Bill, Jim Claar, Steve Mighton, Bob Naney, Tony Rinaldi, Fred Wahl, Nancy Warren, Dick Wenger, Al Williamson, Lyle Lewis, Bryon Holt, Gary Patton, Joel Trick, Anne Vandehey, and Steve Gniadek. 2000. Canada lynx conservation assessment and strategy. United States Department of Agriculture Forest Service, United States Department of the Interior Bureau of

Land Management, United States Department of the Interior Fish and Wildlife Service and United States Department of the Interior National Park Service. 120 pp.

Ruggiero, Leonard F., K. B. Aubry, S. W. Buskirk, G. M. Koehler, C. J. Krebs, K. S. McKelvey, and J. R. Squires. 1999. Ecology and Conservation of Lynx in the United States. Univ. Press of Colorado. Boulder, CO and United States Department of Agriculture, Forest Service, Rocky Mountain Research Station. General Technical Report, RMRS-GTR-30WWW, October. 480p

Ruggiero, Leonard F., Keith B. Aubry, Steven W. Buskirk, L. Jack Lyon, and William J. Zielinski. 1994. The scientific basis for conserving forest carnivore's American marten, fisher, lynx, and wolverine in the western United States. General Technical Report RM-254. Fort Collins, CO: United States Department of Agriculture, Forest Service.

Saab, Victoria A., Robin E. Russell, and Jonathan G. Dudley. 2007. Nest densities of cavity-nesting birds in relation to postfire salvage logging and time since wildfire. Condor 109:97-108. http://www.rmrs.nau.edu/publications/rmrs_2007_Saab_et_al/rmrs_2007_Saab_et_al.pdf

Saab, Victoria, and Jonathan Dudley. 1998. Responses of cavity-nesting birds to stand-replacement fire and salvage logging in ponderosa pine/Douglas-fir forests of southwestern Idaho. United States Department of Agriculture Forest Service, Rocky Mnt. Res. Sta., Ogden, UT. Res. Paper RMRS-RP-11. 17 p. http://www.rmrs.nau.edu/publications/saab_dudley_1998/saab_dudley_1998.pdf

Samson, Fred B. 2006a. A conservation assessment of the northern goshawk, black-backed woodpeckers, flammulated owl, and pileated woodpecker in the Northern Region. United States Department of Agriculture, Forest Service.

Scheiman, D.M., Bollinger, E.K., and D.H. Johnson. 2003. Effects of Leafy Spurge Infestations on Grassland Birds. USGS. Northern Prairie Wildlife Research Center. Paper 230. Available at: http://digitalcommons.unl.edu/usgsnpwrc/230.

Schmidt, K.A., and C.J. Whelan. 1999. Effects of exotic Lonicera and Rhamnus on songbird nest predation. Volume 13.6. p. 1502-6.

Schroeder, R.L. 1984. Habitat suitability index models. Blue grouse. United States Fish and Wildlife Service. FWS/OBS-82/10.81. 19 pp.

Schwartz, C.C., J.P. Copeland, N.J. Anderson, J.R. Squires, R.M. Inman, K.S. McKelvey, K.L. Pilgrim, L.P. Waits, and S.A. Cushman. 2009. Wolverine gene flow across a narrow climatic niche. Ecology, 90(11), pp. 3222-3232.

Seastedt, T.R., R.J. Hobbs, and K.N. Suding. 2008. Management of novel ecosystems: are novel approaches required? Front. Ecol. Environ. 6(10): 547-553

Sheley RL, Jacobs JS, Martin JM. 2004. Integrating 2,4-D and sheep grazing to rehabilitate spotted knapweed infestations. Journal of Range Management 57(4):371-375. In: http://www.fws.gov/invasives/stafftrainingmodule/methods/chemical/review.html. Accessed 5/26/13

Sheley, R.L. and J.K. Petroff, eds. 1999. Biology and management of noxious rangeland weeds. Oregon State University Press, Corvallis, OR.

Sheley, R.L., B.E. Olson, and L.Larson. 1997. Effect of weed seed rate and grass defoliations level on diffuse knapweed. Journal of Range Management 50: 39-43.

Sheley, R.L., J.K. Petroff, and M.M. Borman. 1999a. Introduction. In R.L.Sheley and J.K. Petroff, eds. Biology and Management of Noxious Rangeland Weeds. Oregon State University Press, Corvallis, OR.

Sheley, R.L., S. Kedzie-Webb, and B.D. Maxwell. 1999b. Integrated Weed Management on Rangeland. In R.L.Sheley and J.K. Petroff, eds. Biology and Management of Noxious Rangeland Weeds. Oregon State University Press, Corvallis, OR.

Sheley, R.L., T.J. Scejcar and B.D. Maxwell. 1996. A Theoretical Framework for Developing Successional Weed Management Strategies onRangeland. Weed Technology: 10:. 766-773.

Slater, G.L. 2004. Grasshopper Sparrow (Ammodramus savannarum) A Technical Conservation Assessment. Prepared for United States Department of Agriculture Forest Service Rocky Mountain Region, Species Conservation Project. October 2004. 46 pp.

Smith, G.R. 2001. Effects of Acute Exposure to a Commercial Formulation of Glyphosate on the Tadpoles of Two Species of Anurans. Bull. Environ. Contam. Toxicol. 67:483-8.

Squires, J. R., and P. L. Kennedy. 2006. Northern goshawk ecology: an assessment of current knowledge and information needs for conservation management. Studies in Avian Biology 31: 8-62.

Squires, J. R., and R. T. Reynolds. 1997. Northern Goshawk. No. 298. In The birds of North America. The Academy of Natural Sciences, Philadelphia, Pennsylvania, and The American Ornithologists' Union, Washington, DC, USA. Available at; http://bna.birds.cornell.edu/bna/species/298doi:10.2173/bna.298

Stalmaster, M.V. and J.R. Newman. 1978. Behavioral responses of wintering bald eagles to human activity. J. Wildl. Manage. 43:506-513. – Deschutes EIS

State of Oregon. 2004. Pipeline, Oregon Drinking Water News; Oregon Drinking Water Standards, 19(4) Fall 2004. Drinking Water Program, Oregon Health Division. www.dhs.state.or.us/publichealth/dwp

Stebbins, R. C. 1985. The Peterson Field Guide Series: A Field Guide to Western Reptiles and Amphibians. Houghton Mifflin Company, Boston, MA. 336 pp.

Steinlein, T. 2013. Invasive alien plants and their effects on native microbial soil communities. Progress in Botany. 74: 293-319

Sucoff , E., Nichols, T.& Lu, EY. 2001. Herbicide effects on host plants of Karner Blue butterfly and on butterfly development from egg to adult. Department of Forest Resources Staff paper Series Number 151. University of Minnesota College of Natural Resources: St. Paul Minnesota 47 pp. In . United States Department of Interior Fish and Wildlife Service. 2012. Federal Register proposed rule to list the Mardon Skipper as federally threatened or endangered. Volume 77 Number 171. 27 pp.

Suding, K.N., K.D. LeJeune, T.R. Seastedt. 2004. Competitive impacts and responses of an invasive plant: dependencies on nitrogen and phosphorus availability. Oecologia. 141: 526-535

Sullivan, T.P., C. Nowotny, and R.A. Lautenschlager. 1998. Silvicultural use of herbicide in sub-boreal spruce forest: implications for small mammal population dynamics. Journal of Wildlife Management 62(4): p. 1196-206.

Sullivan, T.P/ and D.S. Sullivan. 2003. Vegetation management and exosystem disturbance: impact of glyphosate hervicide on plant and animal diversity in terrestrial systems. Environmental Review 11:37-59.

Sutherland, S. 2004. What makes a weed a weed: life history traits of native and exotic plants in the USA. Oecologia. 141: 24-39

Swenson, J.E.; C.A. Simmons, and C.D. Eustace. 1987. Decrease of sage grouse Centrocercus urophasianus after ploughing of sagebrush steppe. Biological Conservation 41: 125-132.

Syracuse Environmental Research Associates (SERA), Inc. 2001. Sethoxydim [Poast] - Human Health and Ecological Risk Assessment. Fayetteville, New York. October 31, 2001.

Syracuse Environmental Research Associates (SERA), Inc. 2003. Glyphosate Human Health and Ecological Risk Assessment. Fayetteville, New York. March 1, 2003.

Syracuse Environmental Research Associates (SERA), Inc. 2003. Picloram - Revised Human Health and Ecological Risk Assessment. Fayetteville, New York. June 30, 2003.

Syracuse Environmental Research Associates (SERA), Inc. 2003. Triclopyr - Revised Human Health and Ecological Risk Assessment. Fayetteville, New York. March 15, 2003.

Syracuse Environmental Research Associates (SERA), Inc. 2004. Chlorsulfuron Human Health and Ecological Risk Assessment. Fayetteville, New York. November 21, 2004.

Syracuse Environmental Research Associates (SERA), Inc. 2004. Clopyralid Human Health and Ecological Risk Assessment - Final Report. Fayetteville, New York. December 5, 2004.

Syracuse Environmental Research Associates (SERA), Inc. 2004. Imazapic Human Health and Ecological Risk Assessment. Fayetteville, New York. December 23, 2004.

Syracuse Environmental Research Associates (SERA), Inc. 2004. Imazapyr Human Health and Ecological Risk Assessment. Faytetteville, New York. December 18, 2004.

Syracuse Environmental Research Associates (SERA), Inc. 2004. Metsulfuron Methyl Human Health and Ecological Risk Assessment. Fayetteville, New York. December 9, 2004.

Syracuse Environmental Research Associates (SERA), Inc. 2004. Sulfometuron methyl Human health and ecological risk assessment. Fayetteville, New York. December 14, 2004.

Syracuse Environmental Research Associates (SERA), Inc. 2007. Aminopyralid Human health and Ecological Risk Assessment. Fayetteville, New York. Jun. 28, 2007

Syracuse Environmental Research Associates (SERA), Inc. 2007. GLEAMS Driver User Guide, Version 1.8. Fayetteville, New York.

Syracuse Environmental Research Associates (SERA), Inc. 2011. Glyphosate Human health and Ecological Risk Assessment. Fayetteville, New York 13066-0950. March 25, 2011.

Syracuse Environmental Research Associates (SERA), Inc. 2011. Imazapyr Human Health and Ecological Risk Assessment. Fayetteville, New York.

Syracuse Environmental Research Associates (SERA), Inc. 2011. Picloram Human health and Ecological Risk Assessment. Fayetteville, New York 13066-0950. Sep. 29, 2011.

Syracuse Environmental Research Associates (SERA), Inc. 2011. Triclopyr Human health and Ecological Risk Assessment. Fayetteville, New York 13066-0950. May 24, 2011.

The American Naturalist,123:338-353.

Thomas, J. W., H. Black, Jr., R. J. Scherzinger, and R. J. Petersen. 1979. Wildlife Habitats in Managed Forests: The Blue Mountains of Oregon and Washington. [United States Department of Agriculture Agriculture Handbook 553]. Washington, D.C. (Pages 60-77).

Thomas, J.W., D.A. Leckenby, M.Henjum, R.J. Pedersen and L.D. Bryant. 1988. Habitat-Effectiveness Index for Elk on Blue Mountain Winter Ranges. Pacific Northwest Research Station. General Technical Report PNW-GTR-218. Portland, OR. 28 pp.

Thompson, D. Q., Stuckey, R. L.; Thompson, E. B. 1987. Spread, impact, and control of purple loosestrife (Lythrum salicaria) in North American wetlands. Washington, D.C.: United States Department of the Interior Fish and Wildlife Service; Research Report No. 2. 55 p. http://www.npwrc.usgs.gov/resource/plants/loosstrf/index.htm

Trammell, M. A.; Butler, J. L. 1995. Effects of exotic plants on native ungulate use of habitat. Journal of Wildlife Management. 59(4): 808-816. Shawna's 2011 summary

Tu, C.M. 1994. Effects of herbicides and fumigants on microbial activities in soil. Bulletin of Environmental Contamination and Toxicology. 52(1): 12-17

Tu, M., C. Hurd, and J.M. Randall. 2001. Weed Control Methods Handbook: Tools & Techniques for Use in Natural Areas. The Nature Conservancy.

United States Deparment of the Interior, Fish and Wildlife Service. 2013. Federal Register. Proposal to list the distinct population segment of North American wolverine occurring in the contiguous United States as a threatened species under the Endangered Species Act. 28 pp.

United States Deparment of the Interior, Fish and Wildlife Service. 2012. Fedeally listed, proposed, candidate species and species of concern within Grant County, Oregon. August 11, 2012. 3 pp.

United States Deparment of the Interior, Fish and Wildlife Service. 2010. Federal Register. 12 month Finding on a Petition to List the North American Wolverine as Endangered or Threatened.

United States Deparment of the Interior, Fish and Wildlife Service. 2006. Final Environmental Assessment: Designation of Critical Habitat for the Contiguous United States Distinct Population Segment of the Canada Lynx. Denver, Colorado. 74 pp.

United States Deparment of the Interior, Fish and Wildlife Service. 2003. Endangered and threatened wildlife and plants; 90-day finding on a petition to list the western sage grouse. February 7, 2003. Federal Register 68(26): 6500-6504.

United States Department of Agriculture, Agricultural Research Service. 2007. Colony Collapse Disorder (CCD) Steering Committee. Colony collapse disorder action plan. Downloaded June 6, 2008 from: http://www.ars.usda.gov/is/br/ccd/ccd_actionplan.pdf

United States Department of Agriculture, Forest Service 2010. Species Fact Sheet. Silver-bordered Fritillary (*Boloria selene*). 3 pp.

United States Department of Agriculture, Forest Service and Animal and Plan Health Inspection Service. 2012. Gypsy Moth Management in the United Sateas, a Cooperative Approach - Final Environmental Impact Statement. NA-MB-01-12. Newtown Square, Pennsylvania.

United States Department of Agriculture, Forest Service. 1989. Land and Resource Management Plan for the Ochoco NF/Crooked River NG. and Appendices. Pacific Northwest Region. 2,054 pp.

United States Department of Agriculture, Forest Service. 1990. Land and Resource Management Plan for the Malheur National Forest and Appendices. Pacific Northwest Region. Available at: http://www.fs.usda.gov/detail/malheur/landmanagement/?cid=fsbdev3_033814.

United States Department of Agriculture, Forest Service. 1993. Malheur Wild and Scenic River Management Plan.

United States Department of Agriculture, Forest Service. 1993. North Fork of the Malheur Scenic River Management Plan.

United States Department of Agriculture, Forest Service. 1995. Forest Service Manual (FSM) 2600, Wildlife, Fish and Sensitive Plant Habitat Management. R-6 Supplement 2600-95-3, effective 6/29/95.

United States Department of Agriculture, Forest Service. 1995. Regional Forester's Forest Plan Amendment #2. Interim Management Direction Establishing Riparian, Ecosystem and Wildlife Standards for Timber Sales. Revised. 11 pp.

United States Department of Agriculture, Forest Service. 1998. Watershed Protection and Management. Forest Service Manual. R6 Supplement 2500-98-1, Chapter 2520. United States Department of Agriculture Forest Service, Region 6, Portland, OR. 7p.

United States Department of Agriculture, Forest Service. 1999. Noxious Weed Strategy, Pacific Northwest Region, Portland, OR

United States Department of Agriculture, Forest Service. 2001. Guide to Noxious Weed Prevention Practices. www.fs.fed.us/rangelands/ftp/invasives

United States Department of Agriculture, Forest Service. 2001. Special Areas; Roadless Area Conservation Rule 36 CFR Part 294.

United States Department of Agriculture, Forest Service. 2003. Malheur National Forest National Visitor Use Monitoring Report. United States Forest Service, Malheur National Forest, John Day, OR.

United States Department of Agriculture, Forest Service. 2004. Implementing the National Fire Plan Using Livestock Grazing to Manage Vegetation (Official Letter).

United States Department of Agriculture, Forest Service. 2005. Biological Assessment for the United States Department of Agriculture Forest Service, Pacific Northwest Region, Invasive Plant Program. Pacific Northwest Region, Portland, OR. June 17, 2005. 452pp + appendices.

United States Department of Agriculture, Forest Service. 2005. Fisheries Biological Assessment for United States Department of Agriculture Forest Service, Pacific Northwest Region, Invasive Plant Program, Environmental Impact Statement. United States Department of Agriculture Forest Service, Pacific Northwest Region, Portland, OR. 221pp.

United States Department of Agriculture, Forest Service. 2005. Pacific Northwest Region Invasive Plant Program: Preventing and Managing Invasive Plants. Final Environmental Impact Statement. Volumes I, II, and III. (R6-NR-FHP-PR-02-05). Pacific Northwest Region. Oregon (R6 2005 FEIS).

United States Department of Agriculture, Forest Service. 2005. Pacific Northwest Region Invasive Plant Program Record of Decision. Pacific Northwest Region, Portland, OR. October 2005, R6-NR-FHP-PR-02-05. 39 pp. + appendices. (R6 2005 ROD).

United States Department of Agriculture, Forest Service. 2005. Pacific Northwest Region Invasive Plant Program Appendix J. The Effects of Non-herbicidal Methods of Invasive Plant Treatments on Wildlife, Fish and Plants. Pacific Northwest Region, Portland, OR.27 pp.

United States Department of Agriculture, Forest Service. 2005. Pacific Northwest Region Invasive Plant Program Appendix P. Summary of Herbicide Effects to Wildlife. United States Department of Agriculture Forest Service, Pacific Northwest Region, Portland, OR. February 2005. 141 pp.

United States Department of Agriculture, Forest Service. 2006. Lynx Conservation Agreement between United States Department of Agriculture Forest Service and United States Department of the Interior Fish and Wildlife Service. 9 pp.

United States Department of Agriculture, Forest Service. 2007. Spotted Knapweed. Prepared by Alaska Region. R10-TP125. 2 pp.

United States Department of Agriculture, Forest Service. 2008. Malheur National Forest. Environmental Assessment Balance Thinning and Fuels Project. John Day, Oregon.

United States Department of Agriculture, Forest Service. 2008. Memorandum of Understanding between the United States Department of Agriculture and the United States Fish and Wildlife Service to Promote the Conservation of Migratory Birds. 13 pp.

United States Department of Agriculture, Forest Service. 2008. Umatilla and Wallowa-Whitman National Forests Invasive Plant Biological Assessment. Pendleton and Baker City, Oregon.

United States Department of Agriculture, Forest Service. 2009. Malheur National Forest National Visitor Use Monitoring Report. United States Forest Service, Malheur National Forest, John Day, OR.

United States Department of Agriculture, Forest Service. 2010. Gifford Pinchot National Forest and Columbia River Gorge National Scenic Area (Washington Portion) FEIS

United States Department of Agriculture, Forest Service. 2010. Species Fact Sheet. Shortface Lanx (*Fisherola nuttalli*) 6 pp.

United States Department of Agriculture, Forest Service. 2011. Regional Roresters Sensitive Species List. Pacific Northwest Region, Portland Oregon. December, 2011.

United States Department of Agriculture, Forest Service. 2011. Species Fact Sheet. Johnson's Hairstreak (*Callophrys johnsoni*). 8 pp.

United States Department of Agriculture, Forest Service. 2012. Field Guide for Managing Canada Thistle in the Southwest. Southwest Region. TP-R3-16-14.

United States Department of Agriculture, Forest Service. 2012. Field Guide for Managing Knapweeds in the Southwest. United States Department of Agriculture Forest Service Southwest Region. TP-R3-16-14.

United States Department of Agriculture, Forest Service. 2012. Field Guide for Managing Leafy Spurge in the Southwest. United States Department of Agriculture Forest Service Southwest Region. TP-R3-16-14.

United States Department of Agriculture, Forest Service. 2012. National Best Management Practices for Water Quality Management on National Forest System Lands. Volume 1: National Core BMP Technical Guide.

United States Department of Agriculture, Forest Service. 2012. National Best Management Practices for Waer Quality Management on National Forest Service Lands. Volume 1 National Core BMP Technical Guide. F2-990a.

United States Department of Agriculture, Forest Service. 2012. Species Fact Sheet. Columbia Clubtail (*Gomphus lynnae*). 3 pp.

United States Department of Agriculture, Forest Service. 2013. Disturbed WEPP 2.0. Available [ONLINE] @ http://forest.moscowfsl.wsu.edu/cgi-bin/fswepp/wd/weppdist.pl [May 23, 2013]

United States Department of Agriculture, Forest Service. 2013. Natural Resource Manager Database. National Forest Service database for sensitive plant data management. Formerly known as NRIS.

United States Department of Agriculture, Forest Service. 2013. Species Fact Sheet. Harney Basin Duskysnail (Colligurus depressus). 17 pp.

United States Department of Agriculture, Forest Service.1990. ROS Primer and Field Guide.

United States Department of the Interior, Fish and Widlife Service. 2007. Biological Opinion on the effects of the Northern Rocky Mountain Lynx Amendment on the Distinct Population Segment (DPS) of Canada Lynx (Lynx canadensis) in the contiguous United States. 85 pp.

United States Department of the Interior, Fish and Widlife Service. 1999. Bald and Golden Eagle Protection Act. Title 16. Conservation. Chapter 5A. Protection and Conservation of Wildlife. 4 pp.

United States Department of the Interior, Fish and Wildlife Service. 2013. Pygmy Rabbit Fact Sheet. Pacific Region. Available at; http://www.fws.gov/oregonfwo/Species/Data/PygmyRabbit/. Accessed 4/19/2013.

United States Department of the Interior, Fish and Wildlife Service. 2012. Fedeally listed, proposed, candidate species and species of concern within Harney County, Oregon. August 11, 2012. 4 pp.

United States Department of the Interior, Fish and Wildlife Service. 2012. Fedeally listed, proposed, candidate species and species of concern within Crook County, Oregon. August 11, 2012. 3 pp.

United States Department of the Interior, Fish and Wildlife Service. 2012. Fedeally listed, proposed, candidate species and species of concern within Malheur County, Oregon. August 11, 2012. 4 pp.

United States Department of the Interior, Fish and Wildlife Service. 2012. Fedeally listed, proposed, candidate species and species of concern within Baker County, Oregon. August 11, 2012. 3 pp.

United States Department of the Interior, Fish and Wildlife Service. 2011. Federal Register. Reissuance of Final Rule to Identify the Northern Rocky Mountain Population of Gray Wolf as a Distinct Population Segment and to Revise the List of Endangered and Threatened Wildlife. Pp. 25590-25592.

United States Department of the Interior, Fish and Wildlife Service. 2009. Federal Register Revised Designation of Critical Habitat for the Contiguous United States Distinct Population Segment of the Canada Lynx. Vol. 74. No 36, 87 pp.

United States Department of the Interior, Fish and Wildlife Service. 2008. Birds of Conservation Concern. Division of Migratory Bird Management, Arlington, Virginia. 93 pp.

United States Department of the Interior, Fish and Wildlife Service. 2007. National Bald Eagle Management Guidelines. United States Fish and Wildlife Service. 23 p.

United States Department of the Interior, Fish and Wildlife Service. 2006. Amendment to the Canada Lynx Conservation Agreement determining occupied lynx habitat. 17 pp.

United States Department of the Interior, Fish and Wildlife Service. 2005. Federal Register 90 Day Finding ona Petition to List the Pygmy Rabbit as Threatened or Endangered. Vol. 70, No. 97. May 20, 2005. 13 pp.

United States Department of the Interior, Fish and Wildlife Service. 2005. Federal Register Final Rule to Identify the Northern Rocky Mountain Population of Gray Wolf as a Distinct Population Segment and to Revise the List of Endangered and Threatened Wildlife. Vol. 74, No. 62, April 2, 2009. 66 pp.

United States Department of the Interior, Fish and Wildlife Service. 2005. Lynx Recovery Outline. Contiguous United States Distinct Population Segment of the Canada Lynx. 21 pp.

United States Department of the Interior, Fish and Wildlife Service. 2005. Lynx Conservation Agreement between the United States Forest Service and United States Fish and Wildlife Service. 9 pp.

United States Department of the Interior, Fish and Wildlife Service. 2003. Endangered and Threatened Wildlife and Plants; Removing the Western Distinct Population Segment of Gray Wolf From the List of Endangered and Threatened Wildlife. Federal Register: April 1, 2003, Volume 68. No. 62.

United States Department of the Interior, Fish and Wildlife Service. 2002. Chapter 1, Introduction. In: Bull Trout (*Salvelinus confluentus*) Draft Recovery Plan. United States Fish and Wildlife Service, Portland, Oregon. 137 pps.

United States Department of the Interior, Fish and Wildlife Service. 1999. Proposed rule: delist bald eagle (Haliaeetus leucocephalus) in the lower 48 states. Federal Register 64:36453-36464.

United States Department of the Interior, Fish and Wildlife Service. 1995. Endangered and Threatened Wildlife and Plants. Reopening of Comment Period on Proposed Rule to Reclassify the Bald Eagle from Endangered to Threatened. Federal Register 50 CFR Part 17. 15280-15281.

United States Department of the Interior, Fish and Wildlife Service. 1987. Northern Rocky Mountain Wolf Recovery Plan. Denver, Colorado. 119 pp.

United States Department of the Interior, Fish and Wildlife Service. 1986. Recovery Plan for the Pacific Bald Eagle. Portland, OR. 160 pp.

United States Department of the Interior, Fish and Wildlife Service. 1981. Bald Eagle Management Guidelines for Oregon and Washington. 10 pp.

United States Department of the Interior, Geological Service. 2013. Daily Flow Statistics. Website: http://waterdata.usgs.gov/usa/nwis/sw

United States Department of the Interior, Geological Survey. 2007. Pygmy Rabbit Surveys on State Lands in Oregon. Open-File Report 2007-1015. Reston, Virginia. 27 pp.

United States Department of the Interior. Fish and Wildlife Service. 2003. Biological Opinion and Letter of Concurrence for Effects to Bald Eagles, Marbled Murrelets, Northern Spotted Owls, Bull Trout, and Designated Critical Habitat for Marbled Murrelets and Northern Spotted Owls. from Olympic National Forest Program of Activities for August 5, 2003 to December 31, 2008. Lacey Washington. 288 pp.

United States Departmtent of the Interior, Fish and Wildlife Service. 2007. Removing the bald eagle in the lower 48 states from the list of endangered and threatened wildlife. Final Rule. Federal Register/Vol. 72, No. 130. July 9, 2007. 28 pp.

United States Environmental Protection Agency, Office of Pesticide Programs. 2005. Imazapyr: Revised HED Chapter of the Reregistration Eligibility Document (RED). December 8, 2005. United States EPA E-Docket EPA-HQ-OPP-2005-0495

United States Environmental Protection Agency. 2005. Milestone Fact Sheet.

US P.L. 100-577. Omnibus Oregon Wild and Scenic Rivers Act of 1988.

US P.L. 90-542, 1968. Wild and Scenic Rivers Act.

Utah State University. 2013. The Great Basin and Inavsive Weeds. Yellow Starthistle. 1 pp.

Verts, B. J., and L. N. Carraway. 1998. Land Mammals of Oregon. University of California Press, Berkeley, CA. 668 pp.

Wahl, T. R., B. Tweit, and S. G. Mlodinow, editors. 2005. Birds of Washington: status and distribution. Corvallis, OR, United StatesA Oregon State Univ. Press. 436 pp. In Mellen-McLean, Kim 2012d. MIS Information Sheet. Primary Cavity Nesters/Excavators. 29 pp.

Wangemann, S.A. R.A. Kohl, and P.A. Molumeli. 2000. Infiltration and Percolation Influenced by Antecedent Soil Water Content and Air Entrapment. Transactions of the ASAE Vol 43(6): 1517-1523.

Wardle, D. A., Bardgett, R. D., Klironomos, J. N., Setälä, H., Van der Putten, W. H. and Wall, D. H. 2004. Ecological linkages between aboveground and belowground biota. Science 304: 1629-1633

Warren, A.D. 2005. Lepidoptera of North America 6, Butterflies of Oregon: Their Taxonomy, Distribution, and Biology. Contributions of the C.P. Gillette Museum of Arthropod Diversity. Colorado State University, Fort Collins, Colorado. 405 pp. In United States Department of Agriculture Forest Service 2010b. Species Fact Sheet. Silver-bordered Fritillary (Boloria selene). 3 pp.

Weber, K. T., C. L. Marcum, M. G. Burcham, and L. J. Lyon. 2000. Landscape influences on elk vulnerability to hunting. Intermountain Journal of Science 6:86-94.

Weihe, P. E.; Neely, R. K. 1997. The effects of shading on competition between purple loosestrife and broad-leaved cattail. Aquatic Botany. 59:127-138.

Weiher, E., Wisheu, I.C., Keddy, P.A., and Moore, D.R.J. 1996. Establishment, Persistence, and Management Implications of Experimental Wetland Plant Communities. Wetlands 16(2): p.208-18.

Weiss, N.T. and B.J. Verts. 1984. Habitat and distribution of the pygmy rabbit (Sylvilagus idahoensis) in Oregon. Great Basin Naturalist 44: 563-571 – Deschutes NF Weed EIS

Western Bat Working Group. 2005. Species Accounts, Townsend's big-eared bat. Available at http://www.wbwg.org/speciesinfo/species_accounts/vespertilonidae/coto.pdf. Accessed 9/11/11.

Western Regional Climate Center. 2012. Website: http://www.wrcc.dri.edu/

Western Regional Climate Center. 2013. Website: http://www.wrcc.dri.edu/

Whisenant, S.G. 1990. Changing fire frequencies on Idaho's Snake river plains: ecological and management implications. In: McArthur, E.D.; Romney, E. M.; Smith, S. D.; Tueller, P. T. eds. Proceedings of a Symposium on Cheatgrass Invasion, Shrub Die-off, and Other Aspects of Shrub Biology and Management. United States Forest Service Gen. Tech. Rep. INT-276. Ogden, UT.: Intermountain Forest and Range Experiment Station: 4-10.

Wilde, S.B., T.M. Murphy, C.P. Hope, S.K. Habrun, J. Kempton, A. Birrenkott, F. Wiley, W.W. Bowerman, and A.J. Lewitus. 2005. Avian vacuolar myelinopathy linked to exotic aquatic plants and a novel cyanobacterial species. Environmental Toxicology 20 (3) 348-353.

Williamson, J., and S. Harrison. 2002. Biotic and abiotic limits to the spread of exotic revegetation species. Ecological Applications. 12(1): 40-51

Wisdom, M.J., R.S. Holthausen, B.C. Wales, C.D. Hargis, V.A. Saab, D.C. Lee, W.J. Hann, T.D. Rich, M.M. Rowland, W.J. Murphy and M.R. Earnes. 2000. Source habitats for terrestrial vertebrates of focus in the Interior Columbia Basin: Broad-scale trends and management implications, Volume 2 – Group level results. Gen. Tech. Rep. Threatened and Endangered Species, Sensitive Species and Management Indicator Species and the level of analysis required. PNW-GTR-485. pp. 181-190; 199-208; 219-223; 237-241; 242-248; 258-265; 293-297.

Witmer, G. W., S. K. Martin, and R. D. Sayler. 1998. Forest carnivore conservation and management in the interior Columbia Basin: Issues and environmental correlates. General Technical Report GTR-PNW-420. Portland, OR: United States Department of Agriculture Forest Service, Pacific Northwest Research Station, Portland, OR. 51 pp.

Wolfe, B.E. and J.N. Klironomos. 2005. Breaking new ground: soil communities and exotic plant invasion. Bioscience. 55(6): 477-487

Wood, Tamara. 2001. Herbicide Use in the Management of Roadside Vegetation, Western Oregon, 1999-2000: Effects on the Water Quality of Nearby Streams, USGS, Water Resources Investigations Report 01-4065.

Yu, Y.L., X. Wang, Y.M. Luo, J.F. Yang, J.Q. Yu, and D.F. Fan. 2005. Fungal degradation of metsulfuron-methyl in pure cultures and soil. Chemosphere. 60: 460-466

Zavaleta, E. 2000. Valuing ecosystems services lost to Tamarix invasion in the United States. In: H.A. Mooney, R.J. Hobbs, eds. Invasive species in a changing world. Washington, D.C.: Island Press: 261-300.

Zielinski, W. J., K. M. Slauson, C. R. Carroll, C. J. Kent, and D. G. Kudma. 2001. Status of American martens in coastal forests of the Pacific states. Journal of Mammalogy 82:478-490. In Mellen-McLean, Kim, 2012b. MIS Information Sheet. American Marten (Martes Americana). 20 pp.

Zouhar, K. 2004. Cardaria spp. In: Fire Effects Information System, [Online]. United States Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available online at: http://www.fs.fed.us/database/feis/ [2013, June 1].

Zouhar, K., J.K. Smith, S. Sutherland, and M. Brooks. 2008. Wildland fire in ecosystems: fire and nonnative invasive plants. Gen. Tech. Rep. RMRS-GTR-42-vol. 6. Ogden, UT: United States Department of Agriculture Forest Service, Rocky Mountain Research Station. 355 p.

Glossary

Active ingredient (a.i.) - In any pesticide product, the component (a chemical or biological substance) that kills or otherwise controls the target pests - Pesticides are regulated primarily on the basis of active ingredients. The remaining ingredients are called “inerts.”

Acute effect - An adverse effect on any living organism in which severe symptoms develop rapidly and often subside after the exposure stops.

Acute exposure - A single exposure or multiple brief exposures occurring within a short time (e.g., 24 hours or less in humans). The classification of multiple brief exposures as “acute” is dependent on the life span of the organism. (See also, chronic exposure and cumulative exposure.)

Acute toxicity - Any harmful effect produced in an organism through an acute exposure to one or more chemicals.

Additive effect - A situation in which the combined effects of exposure to two chemicals simultaneously is equal to the sum of the effect of exposure to each chemical given alone. The effect most commonly observed when an organism is exposed to two chemicals together is an additive effect.

Adaptive management - A continuing process of action-based planning, monitoring, researching, evaluating, and adjusting with the objective of improving implementation and achieving the goals of the standards and guidelines

Adjuvant(s) - Chemicals that are added to pesticide products to enhance the toxicity of the active ingredient or to make the active ingredient easier to handle or mix.

Adsorption - The tendency of one chemical to adhere to another material such as soil.

Affected Environment - Existing biological, physical, social, and economic conditions of an area subject to change, both directly and indirectly, as the result of a proposed human action.

Agent - Any substance, force, radiation, organism, or influence that affects the body. The effects may be beneficial or injurious.

Agency for Toxic Substances and Disease Registry (ATSDR) - Federal agency within the Public Health Service charged with carrying out the health-related analyses under Comprehensive Environmental

Response, Compensation, and Liability Act (CERCLA) and Superfund Amendments and Reauthorization Act (SARA).

Alluvial deposits may occur after a heavy rain storm.

Ambient - Usual or surrounding conditions.

Amphibian - Any of a class of cold-blooded vertebrates (including frogs, toads, or salamanders) that are intermediate in many characteristics between fishes and reptiles and having gilled aquatic larvae and air-breathing adults.

Anadromous - Fish that spend their adult life in the sea but swim upriver to fresh water spawning grounds to reproduce.

Anaerobic - Life or process that occurs in, or is not destroyed by, the absence of oxygen. (See also, aerobic.)

Anions - Negatively charged ions in solution e.g., hydroxyl or OH- ion. (See also, cations.)

Annual - A plant that endures for not more than a year. A plant which completes its entire life cycle from germinating seedling to seed production and death within a year.

Annual and Life of the Project Caps – The project caps are limitations on the acreage that may be treated annually and over the life of the project.

Bacteria - Microscopic living organisms that metabolize organic matter in soil, water, or other environmental media. Some bacteria can also cause human, animal and plant health problems.

Best Management Practices (BMP) - A practice or combination of practices determined by a state or an agency to be the most effective and practical means (technological, economic, and institutional) of controlling point and non-point source pollutants at levels compatible with environmental quality.

Bioaccumulation - The increase in concentration of a substance in living organisms as they take in contaminated air, water, or food because the substance is very slowly metabolized or excreted (often concentrating in the body fat.)

Bioconcentration - The accumulation of a chemical in tissues of a fish or other organism to levels greater than in the surrounding water or environment.

Bioconcentration Factor (BCF) - The concentration of a compound in an aquatic organism divided by the concentration in the ambient water of the organism.

Biological control - The use of natural enemies, including invertebrate parasites and predators (usually insects, mites, and nematodes,) and plant pathogens to reduce populations of nonnative, invasive plants.

Biological magnification - The process whereby certain substances such as pesticides or heavy metals increase in concentration as they move up the food chain.

Broadcast application - Herbicide treatment method generally used along roads; boom truck spray is directed at target species. Broadcast methods are used for larger infestations where spot treatments would not be effective.

Bryophytes - Plants of the phylum Bryophyta, including mosses, liverworts, and hornworts; characterized by the lack of true roots, stems, and leaves.

Herbicide Use Buffer - A strip of land near a waterway or other environmentally sensitive area where a particular chemical and method of application is restricted, depending on the herbicide ingredient.

Candidate species - Those plant and animal species that, in the opinion of the Fish and Wildlife Service (FWS) or National Oceanic and Atmospheric Administration (NOAA) Fisheries, may qualify for listing as "endangered" or "threatened." The FWS recognizes two categories of candidates. Category 1 candidates are taxa for which the FWS has on file sufficient information to support proposals for listing. Category 2 candidates are taxa for which information available to the FWS indicates that proposing to list is possibly appropriate, but for which sufficient data are not currently available to support proposed rules.

Carcinogen - A chemical capable of inducing cancer.

Categorical Exclusion – A category of actions which do not individually or cumulatively have a significant effect on the human environment and which have been found to have no such effect in procedures adopted by a Federal agency in implementation of these regulations (§1507.3) and for which, therefore, neither an environmental assessment nor an environmental impact statement is required. (40 CFR 1508.4)

Cations - Positively charged ions in a solution. (See also, anion.)

Cation Exchange Capacity (CEC) - An indicator for fertility and adsorption of applied herbicides. The Cation Exchange Capacity (CEC) is an index of available sites for solutes/ions to attach to soil particles. A higher CEC represents increased ability to hold and release various chemical elements – a relative higher capacity for holding nutrients

Characteristic Landscape - The naturally established landscape within a scene or scenes being viewed.

Chemical Control - The use of naturally derived or synthetic chemicals called herbicides to eliminate or control the growth of invasive plants.

Chronic exposure - Exposures that extend over the average lifetime or for a significant fraction of the lifetime of the species (for a rat, chronic exposure is typically about two years). Chronic exposure studies are used to evaluate the carcinogenic potential of chemicals and other long-term health effects. (See also, acute and cumulative exposure.)

Chronic Reference Dose (RfD) - An estimate of a lifetime daily exposure level (in mg/kg/day) for the human population, including sensitive subpopulations, that is likely to be without an appreciable risk of deleterious effects. Chronic RfDs are specifically developed to be protective for long-term exposure to a compound (seven years to lifetime.)

Chronic toxicity - The ability of a substance or mixture of substances to cause harmful effects over an extended period, usually upon repeated or continuous exposure sometimes lasting for the entire life of the exposed organism

Code of Federal Regulations (CFR) - Document that codifies all rules of the executive departments and agencies of the federal government. It is divided into fifty volumes, known as titles. Title 40 of the CFR (referenced as 40 CFR) lists all environmental regulations, including regulations for EPA pesticide programs (40 CFR Parts 150-189).

Competitive Seeding – A treatment method that is intended to reduce the potential for invasive plants to become introduced or to reoccupy a site once target populations have been reduced. This method is often combined with other treatment methods.

Common Control Measures – Integrated weed treatment methods used for a given target invasive plant species. The R6 2005 FEIS contains Appendix N, "Common Control Measures," a compendium of treatment methods for invasive plants known in Oregon and Washington. These methods were updated as a part of development of the Malheur Invasive Plant Treatment EIS.

Congressionally Designated Areas - Areas that require Congressional enactment for their establishment, such as National Parks, Wild and Scenic Rivers, National Recreation Areas, National Monuments, and Wilderness. Also referred to as Congressional Reserves. Includes similar areas established by Executive Order, such as National Monuments.

Connected Actions – An action that would occur at the same time and place, or would be required to occur, in order to implement a proposed action, and therefore would be analyzed in a single NEPA document.

Contaminants - For chemicals, impurities present in a commercial grade chemical. For biological agents, other agents that may be present in a commercial product.

Cultural control - The establishment or maintenance of competitive vegetation, use of fertilizing, mulching, prescribed burning, or grazing animals to control or eliminate invasive plants.

Cumulative Effect (CE) - The impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions—regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor, but collectively significant, actions taking place over a period of time (40 CFR 1508.7).

Cumulative exposure - Exposure resulting from one or more activities that are repeated over a period of time. (See also, acute and chronic exposure.)

Detritus - Loose fragments, particles, or grains formed by the disintegration of organic matter or rocks.

Disturbance - An effect of a planned human management activity, or unplanned native or exotic agent or event that changes the state of a landscape element, landscape pattern, or regional composition.

Dosage/Dose - (1) The actual quantity of a chemical administered to an organism or to which it is exposed. (2) The amount of a substance that reaches a specific tissue (e.g. the liver). (3) The amount of a substance available for interaction with metabolic processes after crossing the outer boundary of an organism.

Dose Response - Changes in toxicological responses of an individual (such as alterations in severity of symptoms) or populations (such as alterations in incidence) that are related to changes in the dose of any given substance.

Drift - The portion of a sprayed chemical that is moved by wind off of a target site.

Early Detection and Rapid Response (EDRR) – Treatment of invasive plants over the life of the project according to the implementation planning process.

Endangered Species - Any species listed in the Federal Register as being in danger of extinction throughout all, or a significant portion, of its range.

Endangered Species Act (ESA) - A law passed in 1973 to conserve species of wildlife and plants, determined by the Director of the U.S. Fish and Wildlife Service or the NOAA Fisheries to be endangered or threatened with extinction in all or a significant portion of its range. Among other measures, ESA

requires all federal agencies to conserve these species and consult with the Fish and Wildlife Service or NOAA Fisheries on federal actions that may affect these species or their designated critical habitat.

Endemic - A species or other taxonomic group that is restricted to a particular geographic region due to factors such as isolation or response to soil or climatic conditions. (Compare to "Indigenous" and "Native.")

Environmental justice - Executive Order 12898 of February 11, 1994 requires federal agencies, to the greatest extent practicable and permitted by law, 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 in the United States and its territories and possessions, the District of Columbia, the Commonwealth of Puerto Rico, and the commonwealth of the Mariana Islands.

Exposure assessment - The process of estimating the amount of contact with a chemical or biological agent that an individual or a population of organisms will receive from a pesticide application conducted under specific, stated circumstances.

Exotic – Non-native species; introduced from elsewhere, but not completely naturalized. (See also alien and introduced species.)

Federal Insecticide and Rodenticide Act (FIFRA) Pesticide Ingredient - An ingredient of a pesticide that must be registered with EPA under the Federal Insecticide, Fungicide, and Rodenticide Act. Products making pesticide claims must submit required information to EPA to register under FIFRA and may be subject to labeling and use requirements.

Fertilization - Treatment method involving adding of nutrients that could improve the success of desirable species; may be limited, depending on species/soil characteristics.

First-choice Herbicides – First-choice herbicides are those that would be used during the first year of treatment of a given primary target species. It is likely be most effective, given the options associated with a given action alternative. First-choice herbicides are often used in combination with non-herbicide methods.

Flora - Plant life, especially all the plants found in a particular country, region, or time regarded as a group. Also, a systematic set of descriptions of all the plants of a particular place or time.

Forage - Food for animals. In this document, term applies to both availability of plant material for wildlife and domestic livestock.

Formulation - A commercial preparation of a chemical including any inerts and/or contaminants.

Fungi - Molds, mildews, yeasts, mushrooms, and puffballs, a group of organisms that lack chlorophyll and therefore are not photosynthetic. They are usually non-mobile, filamentous, and multi-cellular.

Game fish - Species like trout, salmon, or bass, caught for sport. Many of them show more sensitivity to environmental change than non-game fish.

Geographical Information System (GIS) – Maps and data showing location and attributes for natural resources found within a project area.

Grazing animals - Treatment method which requires matching the invasive species with the appropriate grazer for best success.

Groundwater - The supply of fresh water found beneath the Earth's surface, usually in aquifers, which often supply wells and springs.

Groundwater Loading Effects of Agricultural Management Systems (GLEAMS) - A model that displays herbicide concentrations in streams under a variety of soil, climate, and vegetative conditions.

Habitat - The place where a population (e.g., human, animal, plant, microorganism) lives and its surroundings, both living and non-living.

Half-life - The time required for the concentration of the chemical to decrease by one-half.

Hand/Selective application - Herbicide treatment of individual plants through wicking, wiping, injecting stems, etc., with low likelihood of drift or delivery of herbicides away from treatment sites. This method ensures no herbicide directly contacts soil.

Hand-pulling/Grubbing - Treatment method which is labor-intensive but effective on single plants or on small, low-density infestations.

Hazard Quotient (HQ) - The ratio of the estimated level of exposure to a substance from a specific pesticide application to the RfD for that substance, or to some other index of acceptable exposure or toxicity. A HQ less than or equal to one is presumed to indicate an acceptably low level of risk for that specific application.

Hazard identification - The process of identifying the array of potential effects that an agent may induce in an exposed of humans or other organisms.

Herbaceous - A plant that does not develop persistent woody tissue above the ground (annual, biennial, or perennial.) Herbaceous vegetation includes grasses and grass-like vegetation, and broadleaved forbs.

Herbicide - A chemical preparation designed to kill plants, especially weeds, or to otherwise inhibit their growth. May or may not include an additive (adjuvant) such as a surfactant.

Herbicide Application Rate – The amount of herbicide active ingredient that would be used on a treated acre. The maximum rate is the amount allowed by an herbicide label. Typical rate is the average rate used by the Forest Service for invasive plant treatment projects. Lowest rate (or lowest effective rate) is the least amount of herbicide that could be used to reach treatment objectives.

Herbicide Treatment – Any use of herbicide to meet treatment objectives. Herbicide treatments are part of the integrated weed management toolbox. Herbicide treatment may be combined with non-herbicide treatments to meet treatment objectives.

Herbicide Use Buffer – An area adjacent to a stream or other water body where herbicide ingredient or application methods are restricted.

Humus - Organic portion of the soil remaining after prolonged microbial decomposition.

Tribal and Treaty Rights - Native American treaty and other rights or interests recognized by treaties, statutes, laws, executive orders, or other government action, or federal court decisions.

Indian Tribe - Any American Indian or Alaska Native tribe, band, nation, pueblo, community, rancheria, colony, or group meeting the provisions of the Code of Federal Regulations Title 25, Section 83.7 (25 FR 83.7), or those recognized in statutes or treaties with the United States.

Indigenous - An indigenous species is any which were or are native or inherent to an area. (See also, native.)

Inerts - Anything other than the active ingredient in a pesticide product; not having pesticide properties.

Infested area or site - A contiguous area of land occupied by, in this case, invasive plant species. An infested area of land is defined by drawing a line around the actual perimeter of the infestation as defined by the canopy cover of the plants, excluding areas not infested. Generally, the smallest area of infestation mapped will be 1/10th (0.10) of an acre or 0.04 hectares.

Integrated Weed Management (IWM) - An interdisciplinary weed management approach for selecting methods for preventing, containing, and controlling noxious weeds in coordination with other resource management activities to achieve optimum management goals and objectives.

Interdisciplinary Team (IDT) - A group of individuals with varying areas of specialty assembled to solve a problem or perform a task. The team is assembled out of recognition that no one scientific discipline is sufficiently broad enough to adequately analyze the problem and propose action.

Introduced species - An alien or exotic species that has been intentionally or unintentionally released into an area as a result of human activity. (See also exotic, invasive, and noxious.)

Introduction - "The intentional or unintentional escape, release, dissemination, or placement of a species into an ecosystem as a result of human activity" (Executive Order 13122, 2/3/99).

Invasive plant species - An alien plant species whose introduction does or is likely to cause economic or environmental harm or harm to human health (Executive Order 13122, 2/3/99) (See also exotic and introduced species)

Irreversible effect - Effect characterized by the inability of the body to partially or fully repair injury caused by a toxic agent.

Irritant - Non-corrosive material that causes a reversible inflammatory effect on living tissue by chemical action at the site of contact as a function of concentration or duration of exposure.

LC50 (Lethal Concentration50) - A calculated concentration of a chemical in air or water to which exposure for a specific length of time is expected to cause death in 50 percent of a defined experimental animal population.

LD50 (Lethal Dose50) - The dose of a chemical calculated to cause death in 50 percent of a defined experimental animal population over a specified observation period. The observation period is typically 14 days.

Label - All printed material attached to, or part of, the pesticide container.

Land allocation – An management area designated in a Land and Resource Management Plan associated with certain desired conditions, objectives and standards.

Landscape - An area composed of interacting ecosystems that are repeated because of geology, land form, soils, climate, biota, and human influences throughout the area. Landscapes are generally of a size, shape, and pattern which is determined by interacting ecosystems.

Landscape Character - Particular attributes, qualities, and traits of a landscape that give it an image and make it identifiable or unique.

Landscape Setting - The context and environment in which a landscape is set; a landscape backdrop. It is the combination of land use, landform, and vegetation patterns that distinguish an area in appearance and character from other areas.

Leaching - The process by which chemicals on or in soil or other porous media are dissolved and carried away by water, or are moved into a lower layer of soil.

Level of Concern (LOC) - The concentration in media or some other estimate of exposure above which there may be effects.

Lichens - Complex thallophytic plants comprised of an alga and a fungus growing in symbiotic association on a solid surface (such as a rock.)

Littoral zone - (1) That portion of a body of fresh water extending from the shoreline lakeward to the limit of occupancy of rooted plants. (2) The strip of land along the shoreline between the high and low water levels.

Lowest-Observed-Adverse-Effect Level (LOAEL) - The lowest dose of a chemical in a study, or group of studies, that produces statistically or biologically significant increases in frequency or severity of adverse effects between the exposed and control populations.

Manual Control - The use of any non-mechanized approach to control or eliminate invasive plants (i.e. hand-pulling, grubbing)

Material Safety Data Sheet (MSDS) - A compilation of information required under the OSHA Communication Standard on the identity of hazardous chemicals, health and physical hazards, exposure limits, and precautions.

Mechanical Control - The use of any mechanized approach to control or eliminate invasive plants (i.e. mowing, weed whipping).

Microorganisms - A generic term for all organisms consisting only of a single cell, such as bacteria, viruses, protozoa and some fungi.

Minimum tool - Use of a weed treatment alternative that would accomplish management objectives and have the least impact on resources

Modification - A visual quality objective meaning human activities may dominate the characteristic landscape but must, at the same time, utilize naturally established form, line, color, and texture. It should appear as a natural occurrence when viewed in foreground or middleground.

Mollusks - Invertebrate animals (such as slugs, snails, clams, or squids) that have a soft, un-segmented body, usually enclosed in a calcareous shell; representatives found on National Forest System land include snails, slugs, and clams.

Monitoring - A process of collecting information to evaluate if objectives and anticipated or assumed results of a management plan are being realized or if implementation is proceeding as planned.

Morbidity - Rate of disease, injury or illness.

Most Ambitious Treatment Scenario – The most ambitious treatment scenario would treat all known infestations during the first year of implementation and then retreated until management objectives are met. It includes treatments, re-treatments over a series of years, and passive or active restoratino. It is an

assumption that allows for a consistent analysis comparing alterantives given that Forest Service ability funding over the life ofthe project is unknown.

Mowing - Invasive plant treatment method which is limited to level/gently-sloping smooth-surface terrain. Treatment timing is critical, and must be conducted for several consecutive years.

National Environmental Policy Act (NEPA) - An Act passed in 1969 to declare a national policy that encourages productive and enjoyable harmony between humankind and the environment, promotes efforts that prevent or eliminate damage to the environment and biosphere, stimulates the health and welfare of humanity, enriches the understanding of the ecological systems and natural resources important to the nation, and establishes a Council on Environmental Quality.

National Forest Management Act (NFMA) - A law passed in 1976 as an amendment to the Forest and Rangeland Renewable Resources Planning Act, requiring preparation of Forest Plans and the preparation of regulations to guide that development.

National Marine Fisheries Service (NMFS) - The federal agency that is the listing authority for marine mammals and anadromous fish under the ESA.

National Pollutant Discharge Elimination System (NPDES) - As authorized by the Clean Water Act, the National Pollutant Discharge Elimination System (NPDES) permit program controls water pollution by regulating point sources that discharge pollutants into waters of the United States. Point sources are discrete conveyances such as pipes or man-made ditches. Individual homes that are connected to a municipal system, use a septic system, or do not have a surface discharge do not need an NPDES permit; however, industrial, municipal, and other facilities must obtain permits if their discharges go directly to surface waters.

National Visitor Use Monitoring (NVUM) - A permanent, ongoing sampling system which measures national forest visitor demographics, experiences, preferences, and impressions. A stratified random sample is done for 25 percent of the National Forest System each year according to a national research protocol. NVUM responds to the need to better understand the use and importance of, and satisfaction with, National Forest System recreation opportunities.

National Wilderness Preservation System (NWPS) - The Wilderness Act of 1964 established the national Wilderness Preservation System to ensure that certain federally owned areas in the United States would be preserved and protected in their natural condition. The Act defines a wilderness area, in part, as an area which generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable. Areas included in the system are administered for the use and enjoyment of the American people in such manner as to leave them unimpaired for future use and enjoyment as wilderness.

Native species - With respect to a particular ecosystem, a species that, other than as a result of an introduction, historically occurred or currently occurs in that ecosystem (Executive Order 13122, 2/3/99).

Naturalized - Applied to a species that originally was imported from another country but that now behaves like a native in that it maintains itself without further human intervention and has invaded native populations.

Non-target species - Any plant or animal that is not the intended organism to be controlled by a pesticide treatment.

No-Observed-Adverse-Effect level (NOAEL) - Exposure level at which there are no statistically or biological significant differences in the frequency or severity of any adverse effect in the exposed or control populations

No-Observed-Effect-Level (NOEL) - Exposure level at which there are no statistically or biological significant differences in the frequency or severity of any effect in the exposed or control populations.

Noxious weed - "Any living stage (including but not limited to, seeds and reproductive parts) of any parasitic or other plant of a kind, or subdivision of a kind, which is of foreign origin, is new to or not widely prevalent in the United States, and can directly or indirectly injure crops, other useful plants, livestock, or poultry or other interests of agriculture, including irrigation, or navigation or the fish and wildlife resources of the United States or the public health" (Public Law 93-629, January 3, 1975, Federal Noxious Weed Act of 1974).

Outstandingly Remarkable Value (ORV) - A characteristic of rivers or sections of rivers in the national Wild and Scenic River System. In order for a river to be included in the system, it must possess at least one "outstandingly remarkable" value, such as scenic, recreational, geologic, fish, wildlife, historic, cultural, or other similar features. Outstandingly Remarkable Values are values or opportunities in a river corridor which are directly related to the river and which are rare, unique, or exemplary from a regional or national perspective.

Partial Retention - A visual quality objective which in general means human activities may be evident but must remain subordinate to the characteristic landscape.

Pathogen - A living organism, typically a bacteria or virus that causes adverse effects in another organism.

Percolation - Downward flow or filtering of water through pores or spaces in rock or soil.

Perennial Plant- A plant species having a life span of more than 2 years.

Persistence - Refers to the length of time a compound, once introduced into the environment, stays there.

Personal Protective Equipment (PPE) - Clothing and equipment worn by herbicide mixers, loaders and applicators and re-entry workers worn to reduce their exposure to potentially hazardous chemicals and other pollutants.

Pest - An insect, rodent, nematode, fungus, weed or other form of terrestrial or aquatic plant or animal life that is classified as undesirable because it is injurious to health or the environment.

Pesticide - Any substance used for controlling, preventing, destroying, repelling, or mitigating any pest. Includes fungicides, herbicides, fumigants, insecticides, nematicides, rodenticides, desiccants, defoliants, plant growth regulators, etc.

pH - The negative log of the hydrogen ion concentration. A high pH (greater than 7) is alkaline or basic and a low pH (less than 7) is acidic.

Population - A group of individuals of the same species in an area.

Project "Caps" – Limitations on the acreage that may be treated annually and through the life of the project.

Project Design Features (pdf) – Measures that are part of project implementation to ensure that the project is done according to environmental standards and adverse effects are within the scope of those predicted in this Environmental Impact Statement.

Proposed species - Any plant or animal species that is proposed by the Fish and Wildlife Service or NOAA Fisheries in a Federal Register notice to be listed as threatened or endangered.

Recreational Rivers - A classification within the national Wild and Scenic River System. Recreational rivers are those rivers, or sections of rivers, that are readily accessible by road or railroad, that may have some development along their shorelines, and that may have undergone some impoundment or diversion in the past.

Reference Dose (RfD) - The RfD is a numerical estimate of a daily exposure to the human population, including sensitive subgroups such as children, that is not likely to cause harmful effects during a lifetime. RfDs are generally used for health effects that are thought to have a threshold or minimum dose for producing effects.

Registered Pesticides - Pesticide products which have been approved for the uses listed on the label.

Registration - Formal licensing with EPA of a new pesticide before it can be sold or distributed. Under the Federal Insecticide, Fungicide, and Rodenticide Act, EPA is responsible for registration (pre-market licensing) of pesticides on the basis of data demonstrating no unreasonable adverse effects on human health or the environment when applied according to approved label directions.

Restoration - Ecological restoration is the process of assisting the recovery and management of ecological integrity. Ecological integrity includes a critical range of variability in biodiversity, ecological processes and structures, regional and historical context, and sustainable cultural practices. Restoration may be passive (passing of time to allow for site recovery) or active (in this project, active restoration includes seeding, mulching and planting after invasive plants are removed).

Retention - A visual quality objective which in general means human activities are not evident to the casual forest visitor.

Revegetation - The re-establishment of plants on a site - The term does not imply native or nonnative; does not imply that the site can ever support any other types of plants or species and is not at all concerned with how the site ‘functions’ as an ecosystem.

Riparian Area - A geographic area containing an aquatic ecosystem and adjacent upland areas that directly affect it.

Riparian Habitat Areas - Areas along live and intermittent streams, wetlands, ponds, lakes, and unstable and potentially unstable areas where riparian-dependent resources receive primary emphasis. Riparian Habitat Areas are important to the terrestrial ecosystem as well, serving as dispersal habitat for certain terrestrial species.

Risk - The chance of an adverse or undesirable effect, often measured as a percentage.

Risk Assessment - The qualitative and quantitative evaluation performed in an effort to estimate the risk posed to human health and/or the environment by the presence or potential presence and/or use of specific chemical or biological agents.

Scenery Management - The art and science of arranging, planning, and designing landscape attributes relative to the appearance of places and expanses in outdoor settings.

Scenic - Of or relating to landscape scenery; pertaining to natural or natural-appearing scenery; constituting or affording pleasant views of natural landscape attributes or positive cultural elements.

Scenic Rivers - A classification within the national Wild and Scenic River System. Scenic rivers are those rivers, or sections of rivers, that are free of impoundments, with shorelines or watersheds still largely primitive and shorelines largely undeveloped, but accessible in places by roads.

Seen Area - The total landscape area observed based upon landform screening. Seen-areas may be divided into zones of immediate foreground, foreground, middleground, and background. Some landscapes are seldom seen by the public.

Sensitive Species – Sensitive species are 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 and habitat capability that would reduce a species' existing distribution (FSM 2670.5). Management of sensitive species "must not result in a loss of species viability or create significant trends toward federal listing" (FSM 2670.32).

Species of Conservation Concern - Threatened, endangered and proposed species; Regional Forester's Sensitive species, management indicator species, and other identified native species.

Species - "A group of organisms, all of which have a high degree of physical and genetic similarity, generally interbreed only among themselves, and show persistent differences from members of allied groups of organisms." (Executive Order 13122, 2/3/99).

Spot application - Herbicide treatment involving use of a backpack sprayer or other means. Application is aimed at specific target species, with methods of prevention (such as barriers,) to control damage to non-target species.

Standards and guidelines - The rules and limits governing actions, as well as the principles specifying the environmental conditions or levels to be achieved and maintained

Sub-chronic exposure - An exposure duration that can last for different periods of time (5 to 90 days), with 90 days being the most common test duration for mammals. The sub-chronic study is usually performed in two species (rat and dog) by the route of intended use or exposure.

Sub-chronic toxicity - The ability of one or more substances to cause effects over periods from about 90 days but substantially less than the lifetime of the exposed organism. Sub-chronic toxicity only applies to relatively long-lived organisms such as mammals.

Surface water - All water naturally open to the atmosphere (rivers, lakes, reservoirs, streams, impoundments, seas, estuaries, etc.) and all springs, wells, or other collectors which are directly influenced by surface water.

Surfactant - A surface active agent; usually an organic compound whose molecules contain a hydrophilic group at one end and a lipophilic group at the other. Promotes solubility of a chemical, or lathering, or reduces surface tension of a solution.

Synergistic effect - Situation in which the combined effects of exposure to two chemicals simultaneously is much greater than the sum of the effect of exposure to each chemical given alone.

Take - "The term 'take' means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." (Title 16, Chapter 35, Section 1532, Endangered Species Act of 1973)

Threatened species - Plant or animal species likely to become endangered throughout all, or a significant portion of, its range within the foreseeable future. A plant or animal identified and defined in accordance with the 1973 Endangered Species Act and published in the Federal Register.

Threshold - The maximum dose or concentration level of a chemical or biological agent that will not cause an effect in the organism.

Tolerances - Permissible residue levels for pesticides in raw agricultural produce and processed foods. Whenever a pesticide is registered for use on a food or a feed crop, a tolerance (or exemption from the tolerance requirement) must be established. EPA establishes the tolerance levels, which are enforced by the Food and Drug Administration and the Department of Agriculture.

Toxicity - The inherent ability of an agent to affect living organisms adversely. Toxicity is the degree to which a substance or mixture of substances can harm humans or animals.

Toxicology - The study of the nature, effects, and detection of poisons in living organisms. Also, substances that are otherwise harmless but prove toxic under particular conditions. The basic assumption of toxicology is that there is a relationship among the dose (amount), the concentration at the affected site, and the resulting effects.

Treatment Objectives: Treatment objectives reflect the desired outcome depending on the extent, distribution and priority for treating a given invasive plant species.

- **Eradicate**: Eliminate an invasive plant species from a site. This objective generally applies to species that are difficult to control and cover small areas. Some occurrences may be on roadsides (Russian knapweed, squarrose knapweed) and others may occur in intact native vegetation (yellow starthistle, small occurrences of thistles or knapweed, new invaders). This is generally our first priority for treatment.
- **Control**: Reduce the size of the infestation over time; some level of infestation may be acceptable. This objective applies to most of the target species (houndstongue, leafy spurge, perennial pepperweed, sulfur cinquefoil, whitetop) and large infestations of thistles and knapweeds. This is generally our second priority for treatment.
- **Contain**: Prevent the spread of the weed beyond the perimeter of patches or infestation areas mapped from current inventories. This objective applies to target species such as common St. Johnswort. This is generally our third priority for treatment.
- **Suppress**: Prevent seed production throughout the target patch and reduce the area coverage. Prevent the invasive species from dominating the vegetation of the area; low levels may be acceptable. This objective applies to target species such as toadflax that would be treated mainly with biocontrol agents. This is generally our fourth priority for treatment.
- **Tolerate**: Accept the continued presence of established infestations and the probable spread to ecological limits for certain species. This category is for species that are so widespread and abundant that other objectives would be extremely difficult to meet. This category includes species such as cheatgrass, medusahead, North Africa grass, dandelion, mullein, and bulbous bluegrass. These invasive plants have low priority for treatment and would likely only be treated if they happen to be near one of the primary target species.

U.S. Fish and Wildlife Service (United States Department of the Interior Fish and Wildlife Service, USDI FWS, USFWS) - The federal agency that is the listing authority for species other than marine mammals and anadromous fish under the Endangered Species Act.

USDA Forest Service (United States Department of Agriculture Forest Service, FS or USFS) - The federal agency responsible for management of the Nation's National Forest System lands

Viability - Ability of a wildlife or plant population to maintain sufficient size to persist over time in spite of normal fluctuations in numbers, usually expressed as a probability of maintaining a specific population for a specified period.

Viable Population - A wildlife or plant population that contains an adequate number of reproductive individuals appropriately distributed on the planning area to ensure the long-term existence of the species.

Viewshed - Total visible area from a single observer position, or the total visible area from multiple observer position. Viewsheds are accumulated seen-areas from highways, trails, campgrounds, towns, cities, or other viewer locations. Examples are corridor, feature, or basin viewsheds.

Visual Quality Objective - A desired level of excellence based on physical and sociological characteristics of an area. Refers to degree of acceptable alteration of the characteristic landscape.

Well-distributed - Distribution sufficient to permit normal biological function and species interactions, considering life history characteristics of the species and the habitats for which it is specifically adapted.

Wetland - An area that is regularly saturated by surface or ground water and subsequently is characterized by a prevalence of vegetation that is adapted for life in saturated soil conditions. Examples include swamps, bogs, fens, marshes, and estuaries.

Wild and Scenic River System - The Wild and Scenic Rivers Act of 1968 established a system of selected rivers in the United States, which possess outstandingly remarkable values, to be preserved in free-flowing condition. Within the national system of rivers, three classifications define the general character of designated rivers: Wild, Scenic, and Recreational. Classifications reflect levels of development and natural conditions along a stretch of river. Classifications are used to help develop management goals for the river.

Wilderness - Areas designated by Congressional action under the 1964 Wilderness Act. Wilderness is defined as undeveloped federal land retaining its primeval character and influence without permanent improvements or human habitation. Wilderness areas are protected and managed to preserve their natural conditions, which generally appear to have been affected primarily by the forces of nature with the imprint of human activity substantially unnoticeable; have outstanding opportunities for solitude or for a primitive and confined type of recreation; include at least 5,000 acres, or are of sufficient size to make practical their preservation, enjoyment, and use in an unimpaired condition; and may contain features of scientific, educational, scenic, or historical value as well as ecological and geologic interest.

Wild Rivers - A classification within the national Wild and Scenic River System. Wild rivers are those rivers, or sections of rivers that are free of impoundments and generally inaccessible except by trail, with watersheds or shorelines essentially primitive and waters unpolluted.

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Watershed, ix, 9, 83, 88, 101, 150, 153, 157, 159, 161, 162, 164, 169, 213, 284, 307, 308, 309, 312, 313, 315, 316, 317, 318, 319, 321, 322, 323, 324, 325, 326, 328, 329, 330, 332, 333, 335, 336, 337, 338, 339, 341, 342, 343, 344, 345, 346, 348, 349, 350, 352, 353,355
wetlands, 303
Wild and Scenic Rivers, 10, 32, 253, 254, 255, 256, 257, 258, 288, 293, 303
Wilderness Act, 10, 33, 254, 298, 303
Wilderness Area, 33, 254, 257
Wildlife, ix, x, 16, 10, 14, 38, 63, 67, 99, 106, 147, 166, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 181, 184, 185, 197, 198, 203, 214, 220, 265, 266, 267, 268, 270, 271, 273, 274, 275, 276, 277, 278, 279, 280, 281, 283, 284, 285, 286, 287, 288, 292, 293,300, 302
Wolverine, 172, 174, 175, 176, 215, 267, 270, 273, 274, 275, 280, 283
Woodpecker, 186, 187, 190, 191, 192, 193, 194, 227, 267, 275, 276

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Appendix A – Invasive Plant Inventory Watershed Analysis for the Malheur National Forest

Prepared by Joseph H. Rausch

December 3, 2012

This report presents an analysis of known invasive plants sites by watershed (HUC 5). Also included are other important attributes or concerns about the watersheds that may be associated with the treatment of invasive plants. The analysis is presented in watershed groups of the same basin (HUC 3), sub-basin (HUC4), or portions of sub-basins.

The map that follows and the corresponding figures on the following pages show the geographic extent of the watershed groups and the levels of infestations, respectively.

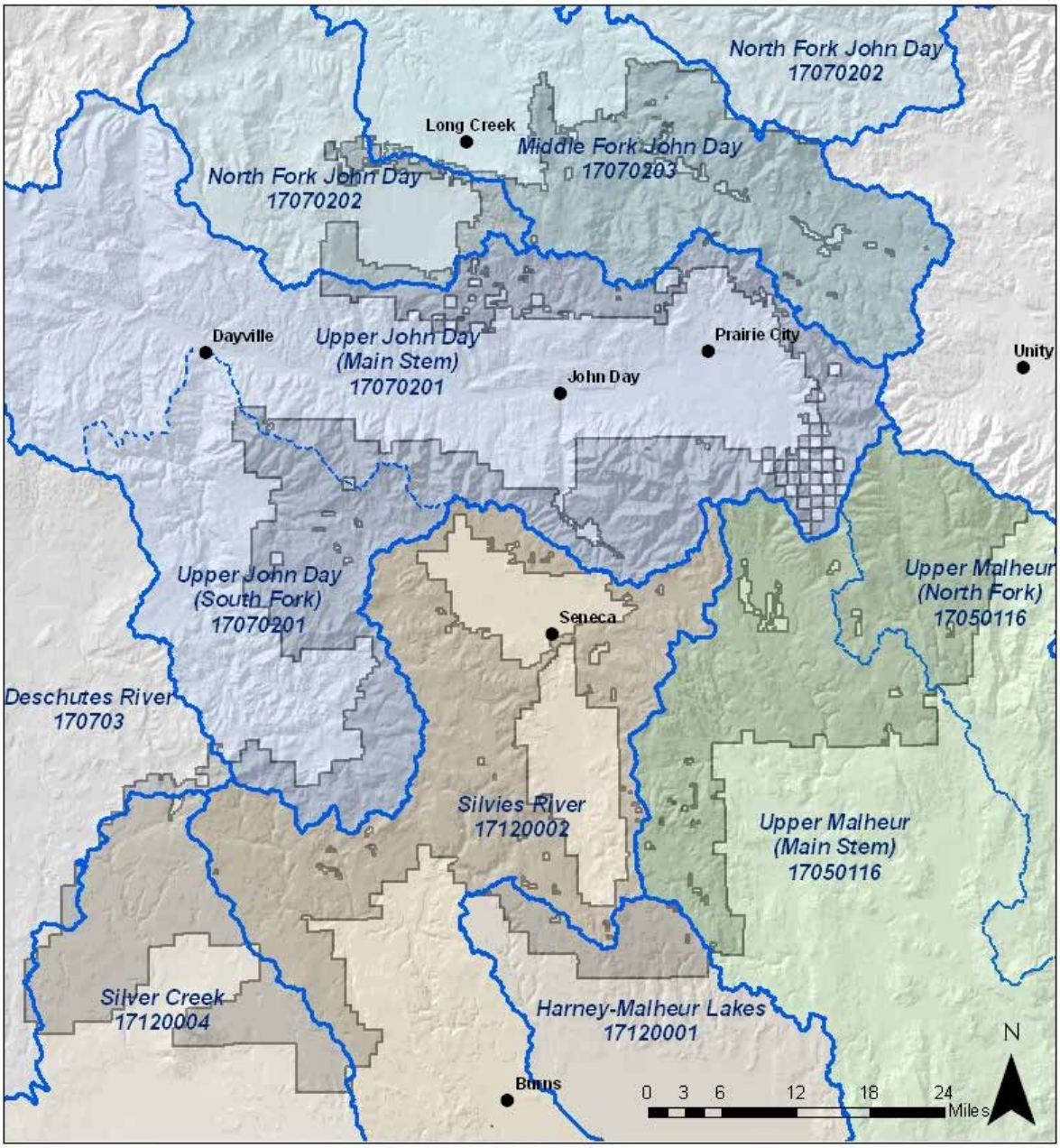


Figure A- 1. Watershed Groups

Summary of Invasive Plant Infestations by Watershed

In figure A- 2 that follows, Colors represent the watershed group as presented in figure A- 1on the previous page; the first column indicates the watershed group (by basin, sub-basin, or a portion thereof), and the second column indicates the 5th field HUC. The individual watershed summaries that follow are generally presented in the order shown above.

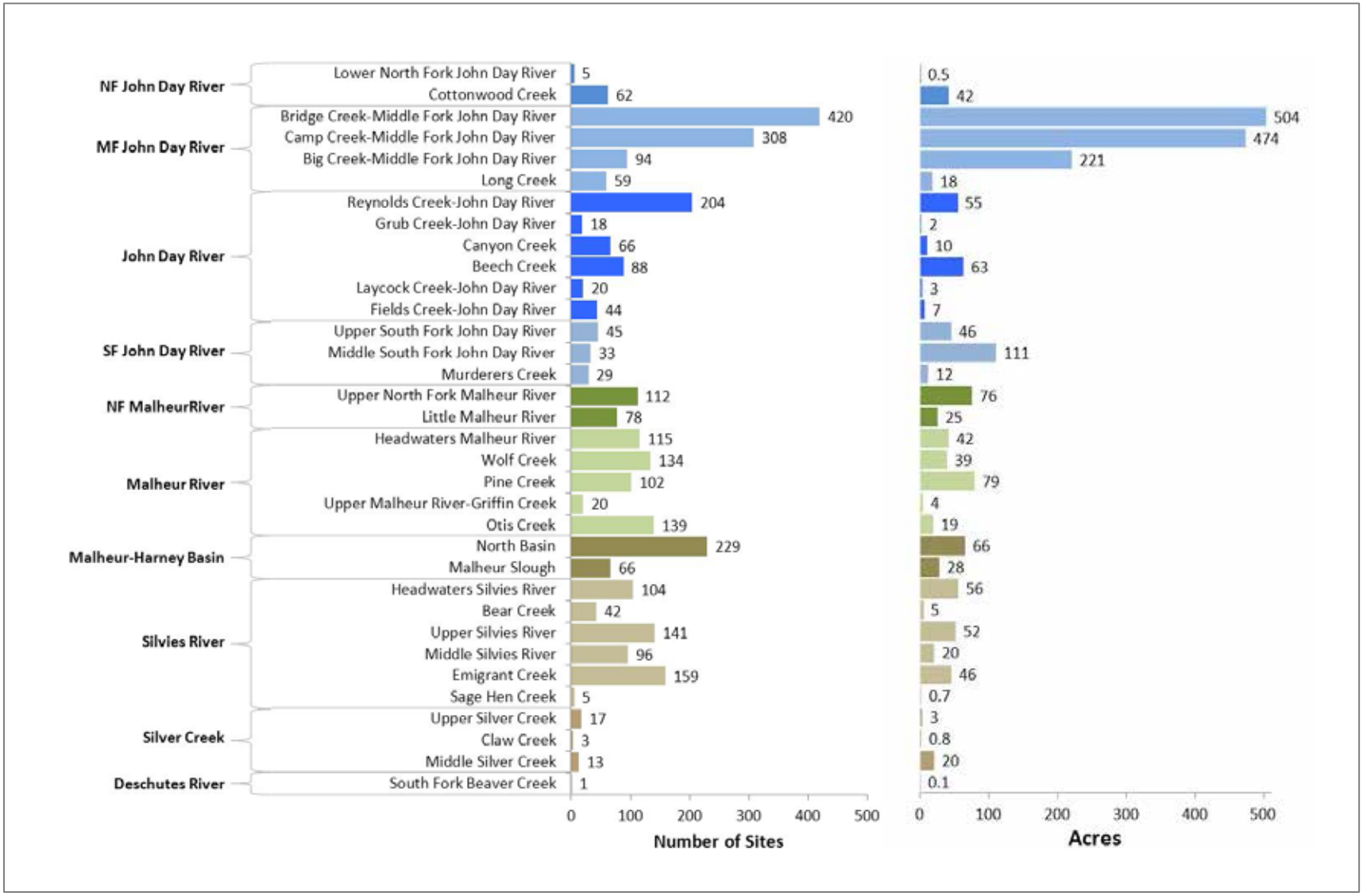


Figure A- 2. Invasive plants infestation summary

North Fork John Day Sub-basin (17070202)

Cottonwood Creek (1707020209)

Lower North Fork John Day River (1707020210)

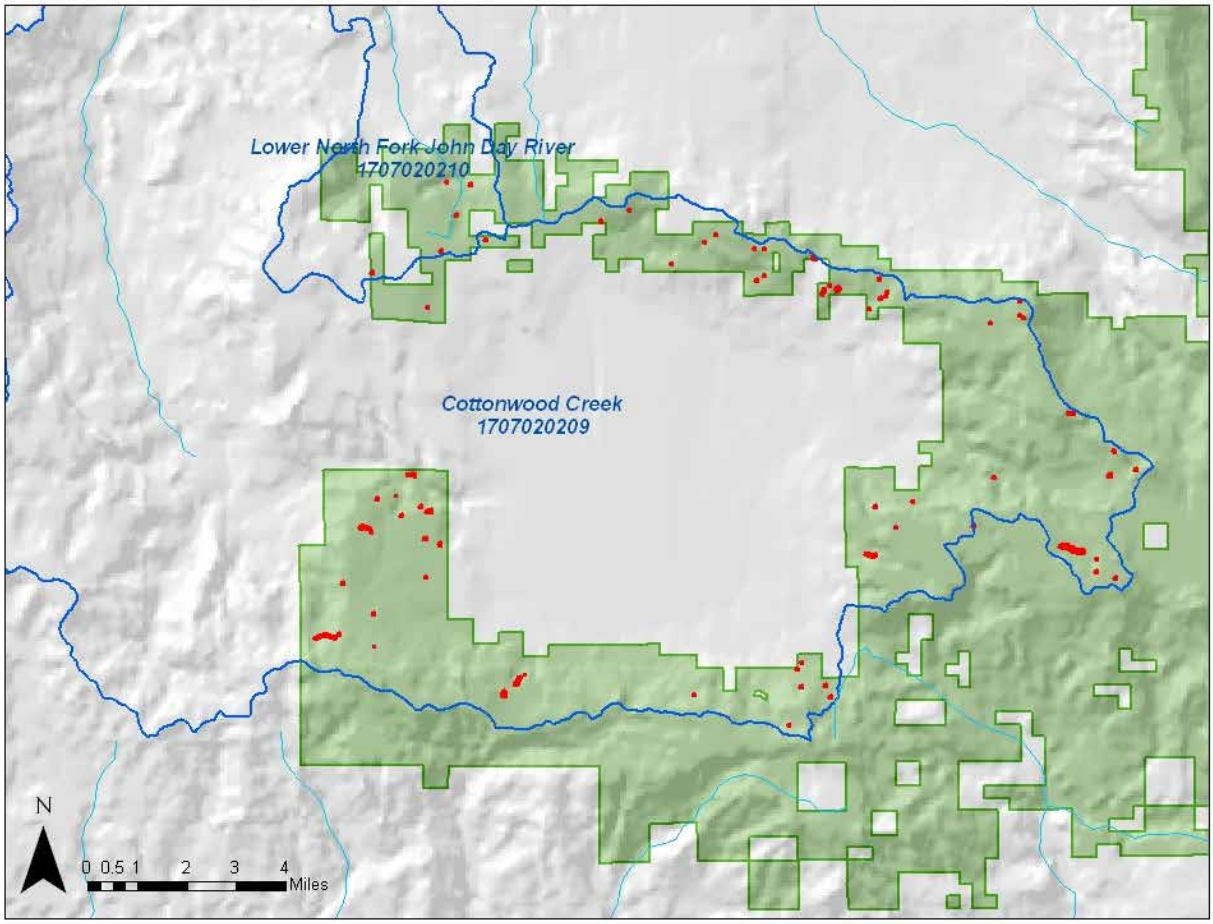
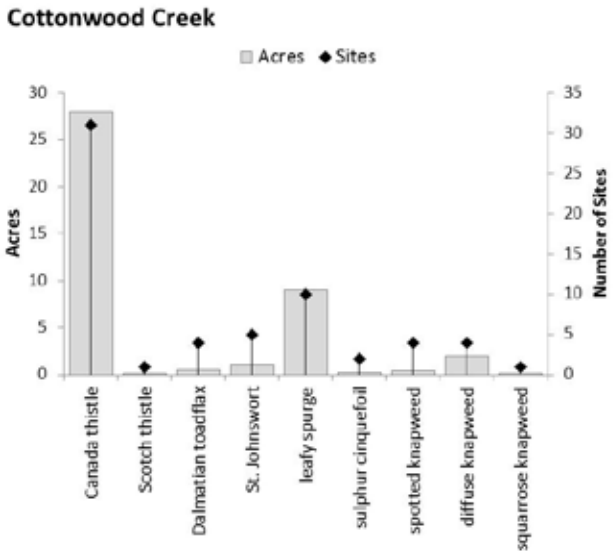


Figure A- 3. North Fork John Day Sub-basin (17070202)

Cottonwood Creek (1707020209)

Ranger district:	Blue Mountain RD
County:	Grant
Total FS acreage:	32,994
Special land uses:	none
Major streams and water bodies:	Fox Creek
Recreation:	dispersed campsites
Grazing allotments:	Fox, Highway, King, Indian Ridge, Donaldson, Beech Creek, Mt. Vernon/John Day, Ferg, Deep Creek
Watershed regional priorities:	within Whole Watershed Restoration Initiative (WWRI) Priority Basin (John Day)
Major roads and/or infested roads:	US-395, 3945, 3940, 3970, 3950
TES species of concern:	steelhead
Comments:	none

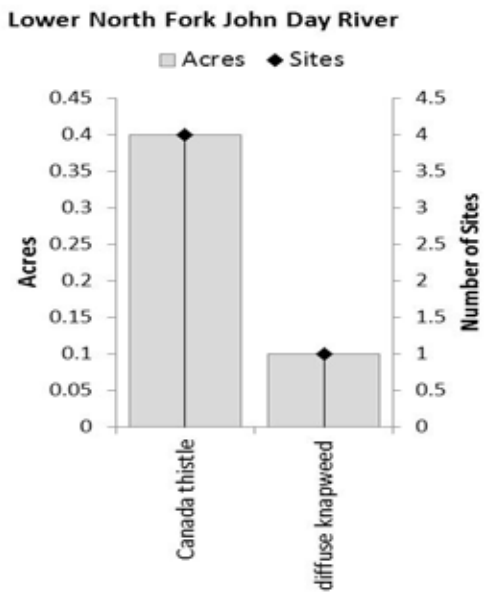


Species	Watershed Total	
	Sites	Acres
Canada thistle	31	28
Scotch thistle	1	0.1
Dalmatian toadflax	4	0.5
St. Johnswort	5	1
leafy spurge	10	9
sulphur cinquefoil	2	0.2
spotted knapweed	4	0.4
diffuse knapweed	4	2
squarrose knapweed	1	0.1
TOTAL	**62**	**41**

Invasive Species	Within 100 ft. of Stream		Within 25 ft. of Stream		Within 100 ft. of TES Plant		
	Sites	Acres	Sites	Acres	Sites	Distance	TES Species
Canada thistle	8	4	6	1			
Leafy spurge	2	0.1	1	0.07			
TOTAL	**10**	**4**	**7**	**1**	**0**	**–**	**0**

Lower North Fork John Day River (1707020210)

Ranger district:	Blue Mountain RD
County:	Grant
Total FS acreage:	3,632
Special land uses:	None
Major streams and water bodies:	Deer Creek
Recreation:	Dispersed Campsites
Grazing allotments:	Hamilton, Deep Creek, King
Watershed regional priorities:	Within Whole Watershed Restoration Initiative (WWRI) Priority Basin (John Day)
Major roads and/or infested roads:	None
TES species of concern:	Steelhead
Comments:	None



Species	Watershed Total	
	Sites	Acres
Canada thistle	4	0.4
diffuse knapweed	1	0.1
TOTAL	**5**	**0.5**

Invasive Species	Within 100 ft. of Stream		Within 25 ft. of Stream		Within 100 ft. of TES Plant		
	Sites	Acres	Sites	Acres	Sites	Distance	TES Species
Canada thistle	2	0.2	1	0.07			
TOTAL	**2**	**0.2**	**1**	**0.07**	**0**	**–**	**0**

Middle Fork John Day Sub-basin (17070203)

Bridge Creek- Middle Fork John Day River (1707020301)

Camp Creek- Middle Fork John Day River (1707020302)

Big Creek- Middle Fork John Day River (1707020303)

Long Creek (1707020304)

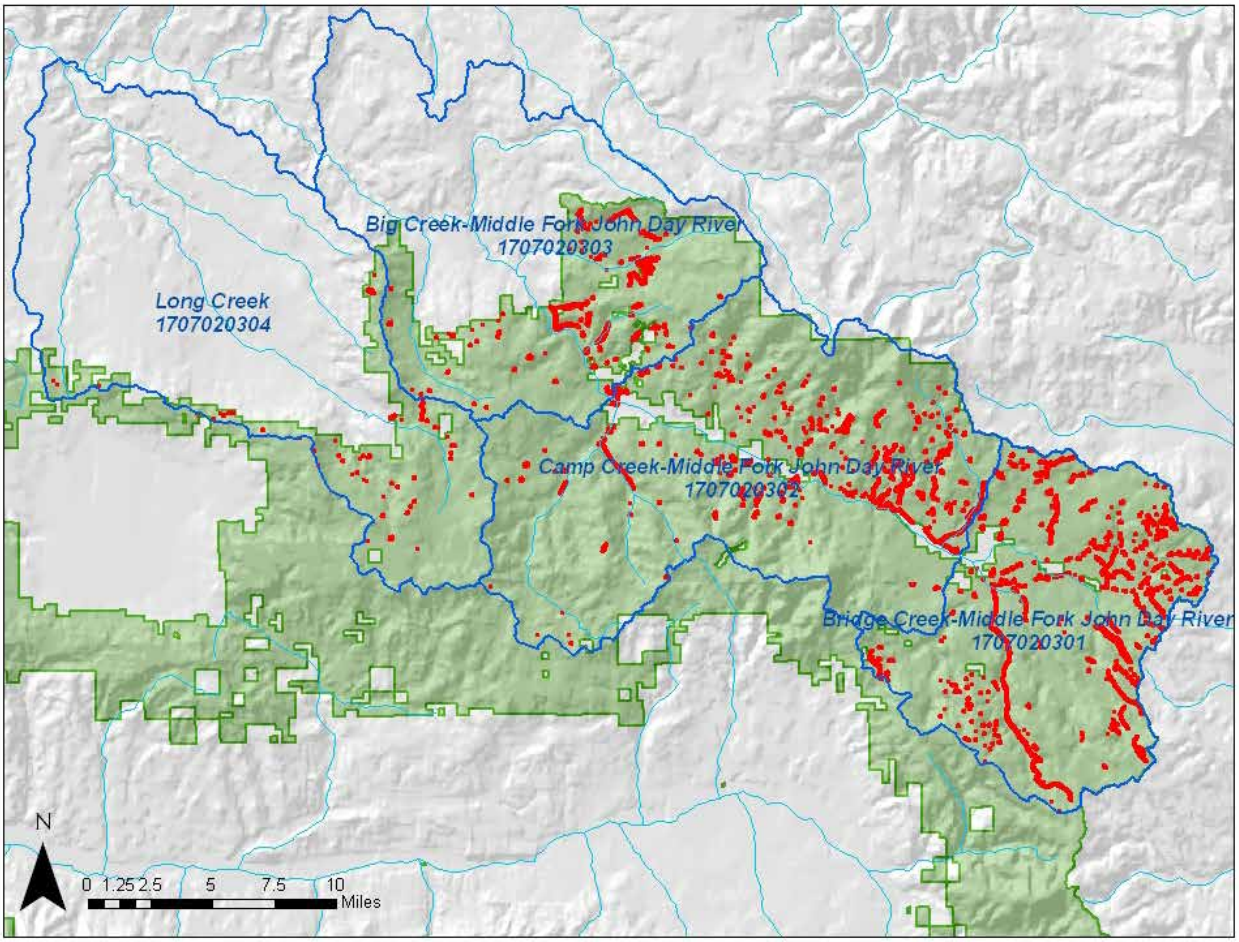
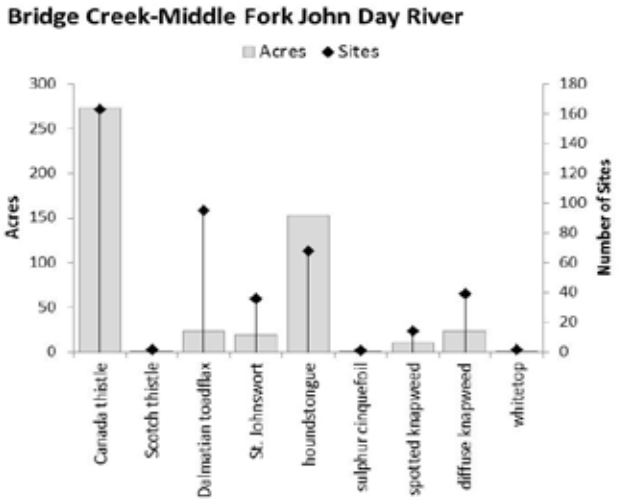


Figure A- 4. Middle Fork John Day Sub-basin (17070203)

Bridge Creek- Middle Fork John Day River (1707020301)

Ranger district:	Blue Mountain RD, Prairie City RD
County:	Grant
Total FS acreage:	75,877
Special land uses:	None
Major streams and water bodies:	Middle Fork John Day River, Crawford Creek, Clear Creek, Lunch Creek, Bridge Creek, Summit Creek, Crawford Creek
Recreation:	Dixie CG, Sumpter Valley Interpretive Site, Dispersed Campsites
Grazing allotments:	Sullens, Blue Mountain, Austin, Upper Middle Fork
Watershed regional priorities:	Within Whole Watershed Restoration Initiative (WWRI) Priority Basin (John Day)
Major roads and/or infested roads:	US-26, OR-7, 2620, 2622, 1940, 1940-275, 1940-220, 1940-281, 1940-552, 2645, 2645-019, 2645-017, 2645-025, 2645-011, 2645-299, 2646, 2646-410, 2646-435, 2646-284, 2640, 2635, 2600-343, 2600-503 (closed)
TES species of concern:	steelhead, bull trout, *Helodium blandowii*
Comments:	A large portion of the Journey Through Time Scenic Byway (US-26, OR-7) traverses this watershed; major grazing allotments in this area are vacant or are in non-use

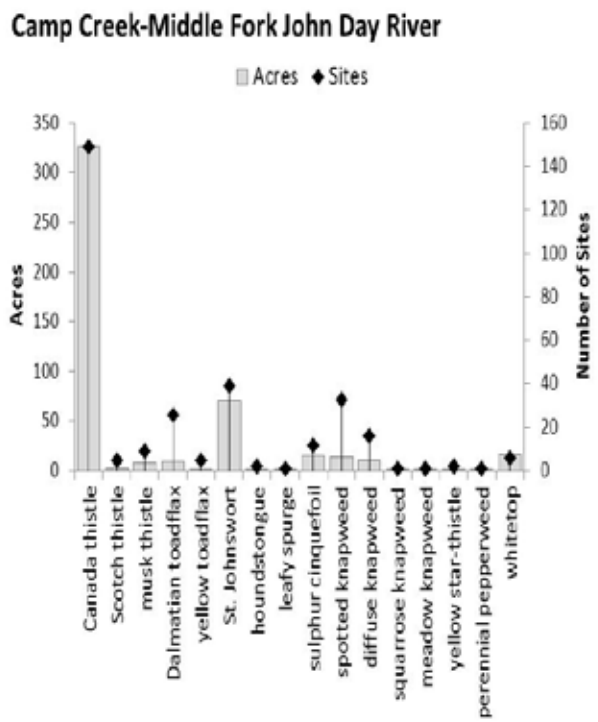


Species	Watershed Total	
	Sites	Acres
Canada thistle	163	273
Scotch thistle	2	0 .3
Dalmatian toadflax	95	24
St. Johnswort	36	19
houndstongue	68	153
sulphur cinquefoil	1	0 .1
spotted knapweed	14	10
diffuse knapweed	39	24
whitetop	2	0 .2
TOTAL	420	504

Invasive Species	Within 100 ft. of Stream		Within 25 ft. of Stream		Within 100 ft. of TES Plant		
	Sites	Acres	Sites	Acres	Sites	Distance	TES Species
Canada thistle	69	66	45	14			
Scotch thistle	1	0 .1	1	0 .007			
Dalmatian toadflax	16	2	9	0 .5			
St. Johnswort	14	3	7	1			
houndstongue	21	12	12	2	1	30 ft.	*Helodium blandowii*
sulphur cinquefoil	1	0 .1	1	0 .03			
spotted knapweed	8	4	3	1			
diffuse knapweed	16	6	11	0.9			
TOTAL	**146**	**94**	**89**	**20**	**1**	**–**	**1**

Camp Creek- Middle Fork John Day River (1707020302)

Ranger district:	Blue Mountain RD
County:	Grant
Total FS acreage:	119,047
Special land uses:	Vinegar Hill-Indian Rock Scenic Area, Dixie Mountain Proposed Research Natural Area
Major streams and water bodies:	Middle Fork John Day River, Vinegar Creek, Vincent Creek, Little Boulder Creek, Granite Boulder Creek, Ruby Creek, Big Boulder Creek, Lick Creek, Camp Creek
Recreation:	Camp Creek CG, Middle Fork CG, Middle Fork Day Use Site, Deerhorn CG, dispersed campsites
Grazing allotments:	Upper Middle Fork, Lower Middle Fork, Long Creek, Slide Creek, Camp Creek, Balance Creek
Watershed regional priorities:	Focus Watershed within Priority Basin (John Day) of the Whole Watershed Restoration Initiative (WWRI)
Major roads and/or infested roads:	County Road-20, 2045, 2050, 2055, 2055-518 (closed), 2055-364 (closed), 2055-432 (closed), 2010, 2614, 2000-120, 2000-139 (closed), 2000-612 (closed), 3600, 3650, 3660, 3670, 3675, 4500, 4550, 4555, 4557, 4559, 4559-283, 4559-284
TES species of concern:	steelhead, bull trout, Phacelia minutissima (no known invasive plants within 100 ft.)
Comments:	None

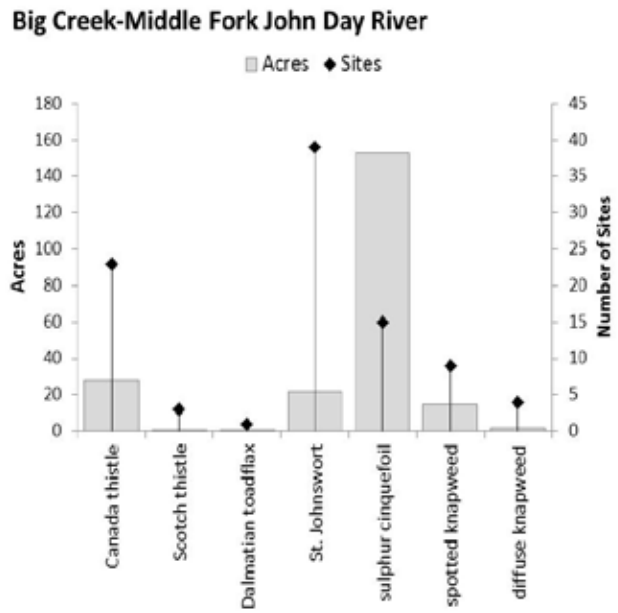


Species	Watershed Total	
	Sites	Acres
Canada thistle	149	326
Scotch thistle	5	2.0
musk thistle	9	8.0
Dalmatian toadflax	26	10.0
yellow toadflax	5	0.5
St. Johnswort	39	70.0
houndstongue	2	0.6
leafy spurge	1	0.1
sulphur cinquefoil	12	15.0
spotted knapweed	33	14.0
diffuse knapweed	16	11.0
squarrose knapweed	1	0.1
meadow knapweed	1	0.1
yellow star-thistle	2	1.0
perennial pepperweed	1	0.1
whitetop	6	16.0
Total	**308**	**475**

Invasive Species	Within 100 ft. of Stream		Within 25 ft. of Stream		Within 100 ft. of TES Plant		
	Sites	Acres	Sites	Acres	Sites	Distance	TES Species
Canada thistle	65	63	42	21			
musk thistle	2	0 .1					
Dalmatian toadflax	11	1	7	0 .3			
yellow toadflax	4	0 .4	1	0 .07			
St. Johnswort	16	15	13	4			
houndstongue	1	0 .05					
sulphur cinquefoil	6	3	3	0 .2			
spotted knapweed	17	5	11	1			
diffuse knapweed	4	1	3	0 .2			
squarrose knapweed	1	0 .07					
meadow knapweed	1	0 .1	1	0 .01			
yellow star-thistle	1	0 .1					
perennial pepperweed	1	0 .03					
whitetop	1	5	1	2			
Total	**133**	**95.0**	**82**	**29**	**0**	**–**	**0**

Big Creek- Middle Fork John Day River (1707020303)

Ranger District:	Blue Mountain RD
County:	Grant
Total FS acreage:	45,722
Special land uses:	Vinegar Hill-Indian Rock Scenic Area
Major streams and water bodies:	Middle Fork John Day River, Deep Creek, Big Creek, Slide Creek, Elk Creek, Mud Lake
Recreation:	Dispersed Campsites
Grazing allotments:	Slide Creek, York, Lower Middle Fork, Camp Creek, Bear Creek
Watershed regional priorities:	Within Whole Watershed Restoration Initiative (WWRI) Priority Basin (John Day)
Major roads and/or infested roads:	County Road-20, 2000-893, 2000-621, 2000-893, 2000-978 (closed), 2090, 2090-048, 2090-519, 2090-521 (closed), 3690, 3514, 4500, 4560, 4560-155 (closed), 4560-570 (closed)
TES species of concern:	steelhead, bull trout
Comments:	None

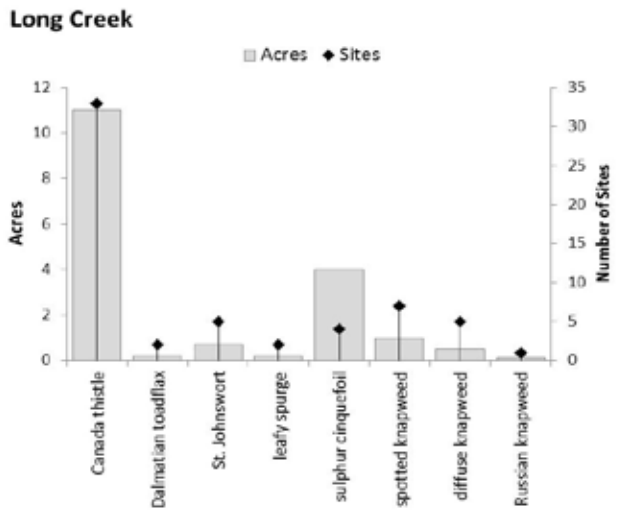


Species	Watershed Total	
	Sites	Acres
Canada thistle	23	28.0
Scotch thistle	3	0.4
Dalmatian toadflax	1	0.2
St. Johnswort	39	22.0
sulphur cinquefoil	15	153.0
spotted knapweed	9	15.0
diffuse knapweed	4	2.0
Total	**94**	**221**

Invasive Species	Within 100 ft. of Stream		Within 25 ft. of Stream		Within 100 ft. of TES Plant		
	Sites	Acres	Sites	Acres	Sites	Distance	TES Species
Canada thistle	12	5	9	1			
Dalmatian toadflax	1	0 .2	1	0 .01			
St. Johnswort	18	7	9	1			
sulphur cinquefoil	11	36	10	7			
spotted knapweed	3	2	2	0 .3			
diffuse knapweed	1	0 .1	1	0 .7			
TOTAL	46	50	32	10	0	–	0

Long Creek (1707020304)

Ranger District:	Blue Mountain RD
County:	Grant
Total FS acreage:	29,911
Special land uses:	Long Creek Municipal Water Supply
Major streams and water bodies:	Long Creek
Recreation:	dispersed campsites
Grazing allotments:	Long Creek, War Canyon, Highway, Fox, Keeney Meadows, Mt. Vernon/John Day
Watershed regional priorities:	Within Whole Watershed Restoration Initiative (WWRI) Priority Basin (John Day)
Major roads and/or infested roads:	County Road-18, County Road-35, 3945, 3946
TES species of concern:	Steelhead
Comments:	None



Species	Watershed Total	
	Sites	Acres
Canada thistle	33	11
Dalmatian toadflax	2	0 .2
St. Johnswort	5	0 .7
leafy spurge	2	0 .2
sulphur cinquefoil	4	4
spotted knapweed	7	1
diffuse knapweed	5	0 .5
Russian knapweed	1	0 .1
Total	**59**	**18**

Invasive Species	Within 100 ft. of Stream		Within 25 ft. of Stream		Within 100 ft. of TES Plant		
	Sites	Acres	Sites	Acres	Sites	Distance	TES Species
Canada thistle	6	0 .4	1	0 .04			
St. Johnswort	1	0 .007					
sulphur cinquefoil	1	0 .09	1	0 .0003			
diffuse knapweed	2	0 .1	1	0 .04			
Russian knapweed	1	0 .07					
Total	11	1	3	0 .08	0	–	0

Upper John Day Sub-basin – Main Stem Portion (17070201)

Reynolds Creek-John Day River (1707020105)

Grub Creek-John Day River (1707020106)

Canyon Creek (1707020107)

Beech Creek (1707020108)

Laycock Creek-John Day River (1707020109)

Fields Creek-John Day River (1707020110)

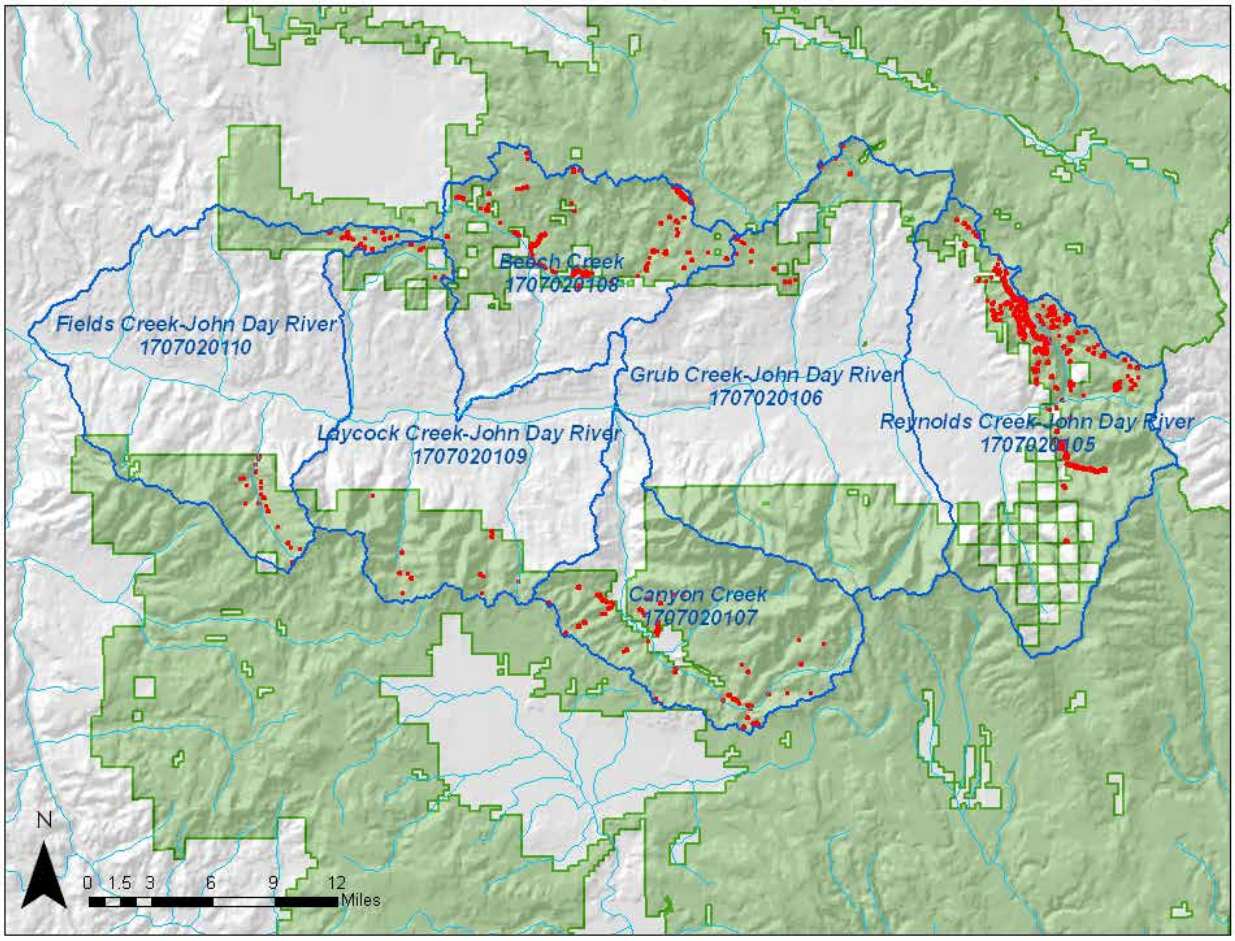
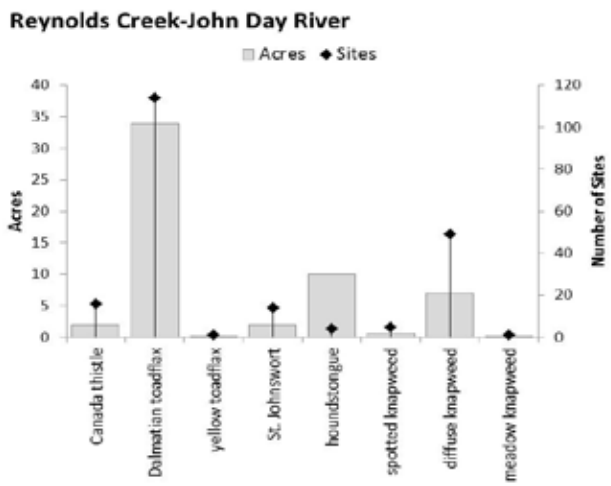


Figure A- 5. Upper John Day Sub-basin – Main Stem Portion (17070201)

Reynolds Creek-John Day River (1707020105)

Ranger district:	Prairie City RD, Blue Mountain RD
County:	Grant
Total FS acreage:	54,573
Special land uses:	Strawberry Mountain Wilderness
Major streams and water bodies:	John Day River, Reynolds Creek, Deardorf Creek, Roberts Creek, Rail Creek, Call Creek
Recreation:	Trout Farm CG, Crescent CG, Sunshine Flat TH, Deardorf TH, Reynold Creek TH, dispersed campsites
Grazing allotments:	Reynolds Creek, Deardorff, Hot Springs, Rail Creek, Dixie
Watershed regional priorities:	Within Whole Watershed Restoration Initiative (WWRI) Priority Basin (John Day)
Major roads and/**o**r infested roads:	US-26, County Road-62, 2600-306, 2600-272 (closed), 2600-390 (closed), 2600-392 (closed), 1300, 1344, 2635, 2635-629
TES species of concern:	Steelhead, Bull Trout
Comments:	None

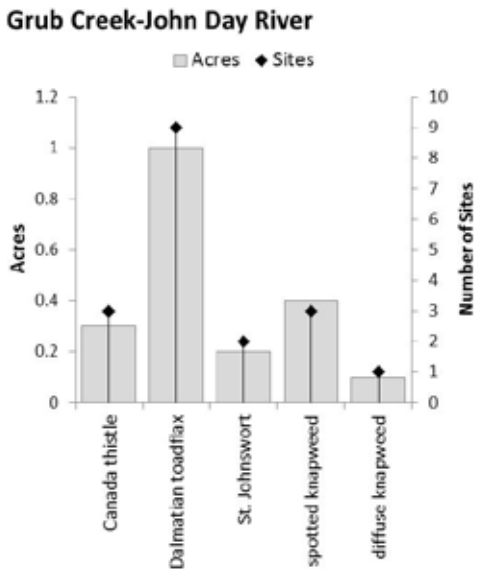


Species	Watershed Total	
	Sites	Acres
Canada thistle	16	2
Dalmatian toadflax	114	34
yellow toadflax	1	0 .1
St. Johnswort	14	2
houndstongue	4	10
spotted knapweed	5	0 .6
diffuse knapweed	49	7
meadow knapweed	1	0 .2
TOTAL	204	56

Invasive Species	Within 100 ft. of Stream			Within 25 ft. of Stream			Within 100 ft. of TES Plant		
	Sites	Acres		Sites	Acres		Sites	Distance	TES Species
Canada thistle	1	0	.05						
Dalmatian toadflax	28	3		17	0	.6			
St. Johnswort	7	0	.6	4	0	.1			
houndstongue	1	0	.5	1	0	.1			
spotted knapweed	1	0	.1	1	0	.06			
diffuse knapweed	10	0	.7	5	0	.1			
meadow knapweed	1	0	.2	1	0	.1			
Total	49	5		29	1		0	–	0

Grub Creek-John Day River (1707020106)

Ranger district:	Blue Mountain RD
County:	Grant
Total FS acreage:	50,089
Special land uses:	Strawberry Mountain Wilderness, Strawberry Mountain Proposed Research Natural Area, Baldy Mountain Proposed Research Natural Area, Dixie Mountain Proposed Research Natural Area
Major streams and water bodies:	Strawberry Creek, Indian Creek, Pine Creek, Dixie Creek, Bear Creek, Grub Creek, Strawberry Lake, Slide Lake, Little Slide Lake
Recreation:	Strawberry Campground, Slide Creek, CG, McNaughton Spring CG, Slide Horse Camp, Slide Creek TH, Onion Creek TH, Strawberry Basin TH, Indian Creek TH, dispersed campsites
Grazing allotments:	Dixie, Roundtop, Indian Creek
Watershed regional priorities:	within Whole Watershed Restoration Initiative (WWRI) Priority Basin (John Day)
Major roads and/or infested roads:	County Road-18, 3670, 5401, 6001
TES species of concern:	steelhead, bull trout, Thelypodium eucosmum (no know invasive plants within 100 ft.), Luina serpentina (no know invasive plants within 100 ft.)
Comments:	none

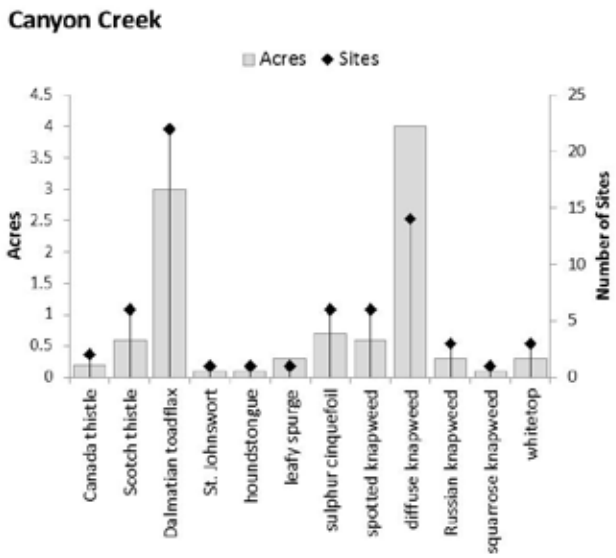


Species	Watershed Total	
	Sites	Acres
Canada thistle	3	0.3
Dalmatian toadflax	9	1
St. Johnswort	2	0.2
spotted knapweed	3	0.4
diffuse knapweed	1	0.1
TOTAL	**18**	**2**

Invasive Species	Within 100 ft. of Stream		Within 25 ft. of Stream		Within 100 ft. of TES Plant		
	Sites	Acres	Sites	Acres	Sites	Distance	TES Species
Canada thistle	1	0.006					
Dalmatian toadflax	1	0.2	1	0.1			
spotted knapweed	3	0.3	1	0.07			
TOTAL	**5**	**0.5**	**2**	**0.2**	**0**	**–**	**0**

Canyon Creek (1707020107)

Ranger district:	Blue Mountain RD
County:	Grant
Total FS acreage:	59,583
Special land uses:	Strawberry Mountain Wilderness, Canyon Creek Research Natural Area
Major streams and water bodies:	Canyon Creek, West Fork Canyon Creek, Middle Fork Canyon Creek, Canyon Meadows Reservoir
Recreation:	Wickiup CG, Canyon Meadows CG, dispersed campsites
Grazing allotments:	Seneca, Dark Canyon, Williams Pasture, Joaquin, Fawn Spring
Watershed regional priorities:	Within Whole Watershed Restoration Initiative (WWRI) Priority Basin (John Day)
Major roads and/or infested roads:	US-395, County Road-65, 1500, 6510, 3920, 1516, 1520, 1530
TES species of concern:	**steelhead**, *Thelypodium eucosmum* (no know invasive plants within 100 ft.)
Comments:	none

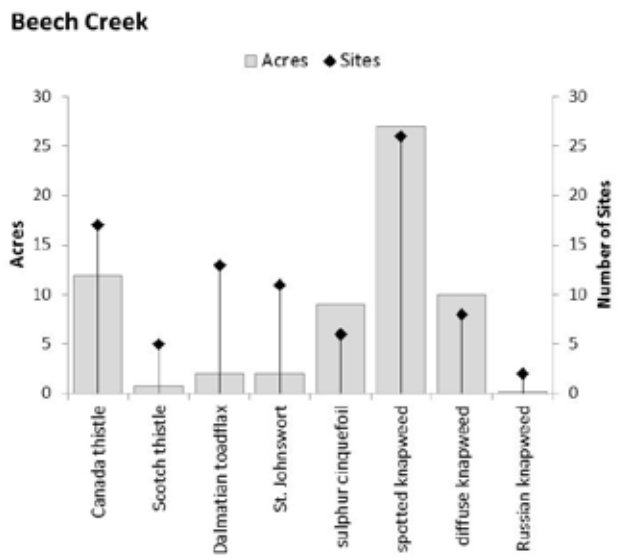


Species	Watershed Total	
	Sites	Acres
Canada thistle	2	0.2
Scotch thistle	6	0.6
Dalmatian toadflax	22	3
St. Johnswort	1	0.1
houndstongue	1	0.1
leafy spurge	1	0.3
sulphur cinquefoil	6	0.7
spotted knapweed	6	0.6
diffuse knapweed	14	4
Russian knapweed	3	0.3
squarrose knapweed	1	0.1
whitetop	3	0.3
TOTAL	**66**	**10**

Invasive Species	Within 100 ft. of Stream		Within 25 ft. of Stream		Within 100 ft. of TES Plant		
	Sites	Acres	Sites	Acres	Sites	Distance	TES Species
Canada thistle	2	0 .2	1	0 .06			
Scotch thistle	2	0 .2	1	0 .1			
Dalmatian toadflax	11	0 .04	4	0 .2			
houndstongue	1	0 .04					
sulphur cinquefoil	2	0 .2					
spotted knapweed	2	0 .2	1	0 .04			
diffuse knapweed	5	2	2	0 .4			
Russian knapweed	1	0 .1	1	0 .01			
squarrose knapweed	1	0 .1	1	0 .08			
whitetop	1	0 .02					
TOTAL	28	4	11	1	0	–	0

Beech Creek (1707020108)

Ranger district:	Blue Mountain RD
County:	Grant
Total FS acreage:	40,568
Special land uses:	none
Major streams and water bodies:	Beech Creek, Clear Creek, Lake Creek, Tinker Creek, Magone Lake
Recreation:	Magone Lake Recreation Area, Beech Creek CG, Raddue Forest Camp, dispersed campsites
Grazing allotments:	Fox, Mt. Vernon/John Day, Beech Creek, McCullough, Herberger, Roundtop
Watershed regional priorities:	within Whole Watershed Restoration Initiative (WWRI) Priority Basin (John Day)
Major roads and/or infested roads:	US-395, County Road-32, 3600, 3618, 3620, 3940, 3900-131
TES species of concern:	steelhead
Comments:	none

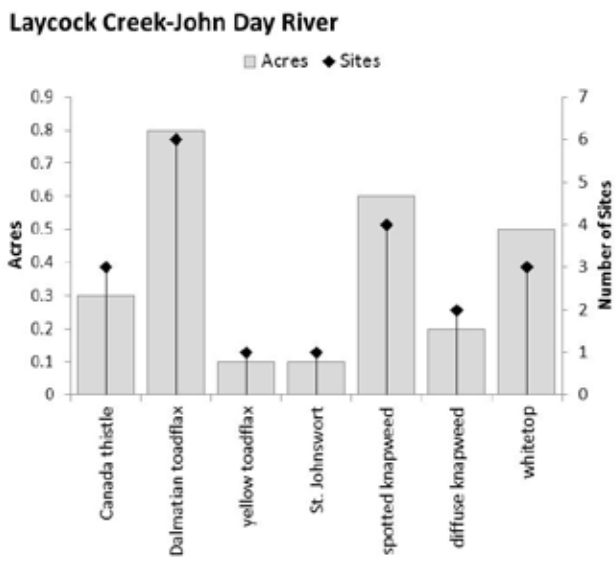


Species	Watershed Total	
	Sites	Acres
Canada thistle	17	12
Scotch thistle	5	0.7
Dalmatian toadflax	13	2
St. Johnswort	11	2
sulphur cinquefoil	6	9
spotted knapweed	26	27
diffuse knapweed	8	10
Russian knapweed	2	0.2
TOTAL	**88**	**63**

Invasive Species	Within 100 ft. of Stream		Within 25 ft. of Stream		Within 100 ft. of TES Plant		
	Sites	Acres	Sites	Acres	Sites	Distance	TES Species
Canada thistle	7	0 .6	3	0 .1			
Scotch thistle	4	0 .3	1	0 .05			
Dalmatian toadflax	9	1	5	0 .3			
St. Johnswort	3	0 .6	1	0 .1			
sulphur cinquefoil	3	3	3	0 .4			
spotted knapweed	15	8	12	2			
diffuse knapweed	6	8	6	3			
Russian knapweed	2	0 .2	1	0 .01			
TOTAL	49	21	32	6	0	–	0

Laycock Creek-John Day River (1707020109)

Ranger district:	Blue Mountain RD
County:	Grant
Total FS acreage:	30,473
Special land uses:	none
Major streams and water bodies:	Riley Creek, Laycock Creek, Birch Creek
Recreation:	dispersed campsites
Grazing allotments:	Deadhorse, Hanscomb, Seneca, McClellan, Field Peak
Watershed regional priorities:	within Whole Watershed Restoration Initiative (WWRI) Priority Basin (John Day)
Major roads and/or infested roads:	4900, 2190
TES species of concern:	steelhead, Thelypodium eucosmum (no know invasive plants within 100 ft.), Luina serpentina (no know invasive plants within 100 ft.)
Comments:	none

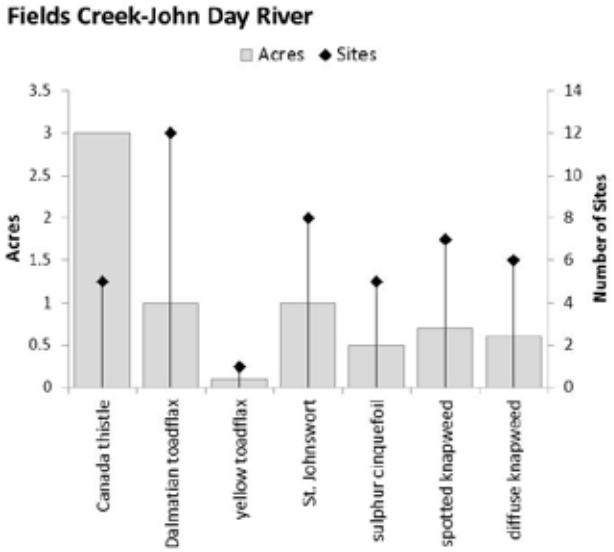


Species	Watershed Total	
	Sites	Acres
Canada thistle	3	0.3
Dalmatian toadflax	6	0.8
yellow toadflax	1	0.1
St. Johnswort	1	0.1
spotted knapweed	4	0.6
diffuse knapweed	2	0.2
whitetop	3	0.5
TOTAL	**20**	**3**

Invasive Species	Within 100 ft. of Stream		Within 25 ft. of Stream		Within 100 ft. of TES Plant		
	Sites	Acres	Sites	Acres	Sites	Distance	TES Species
Canada thistle	2	0 .2	1	0 .06			
Dalmatian toadflax	2	0 .2	1	0 .07			
spotted knapweed	1	0 .05					
diffuse knapweed	1	0 .1	1	0 .08			
whitetop	2	0 .3	1	0 .06			
TOTAL	8	1	4	0 .3	0	–	0

Fields Creek-John Day River (1707020110)

Ranger district:	Blue Mountain RD
County:	Grant
Total FS acreage:	25,296
Special land uses:	Cedar Grove Botanical Special Interest Area
Major streams and water bodies:	Fields Creek, Belshaw Creek
Recreation:	Billy Fields CG, Cedar Grove TH, dispersed campsites
Grazing allotments:	Fields Peak, Aldrich
Watershed regional priorities:	within Whole Watershed Restoration Initiative (WWRI) Priority Basin (John Day)
Major roads and/or infested roads:	2100, 2140, 3955, 3955-486, 3955-417
TES species of concern:	steelhead, Luina serpentina
Comments:	none



Species	Watershed Total	
	Sites	Acres
Canada thistle	5	3
Dalmatian toadflax	12	1
yellow toadflax	1	0.1
St. Johnswort	8	1
sulphur cinquefoil	5	0.5
spotted knapweed	7	0.7
diffuse knapweed	6	0.6
TOTAL	**44**	**7**

Invasive Species	Within 100 ft. of Stream		Within 25 ft. of Stream		Within 100 ft. of TES Plant		
	Sites	Acres	Sites	Acres	Sites	Distance	TES Species
Canada thistle	2	0.2	1	0.08			
Dalmatian toadflax	7	0.5	2	0.1	1	57 ft.	*Luina serpentina*
yellow toadflax	1	0.02					
St. Johnswort	2	0.2	2	0.07			
sulphur cinquefoil	2	0.1					
spotted knapweed	5	0.4	2	0.01	1	51 ft.	*Luina serpentina*
diffuse knapweed	2	0.1					
TOTAL	**21**	**2**	**7**	**0.4**	**2**	**–**	**1**

Upper John Day Sub-basin – South Fork Portion (17070201)

Upper South Fork John Day River (1707020101)

Middle South Fork John Day River (1707020102)

Murderers Creek (1707020103)

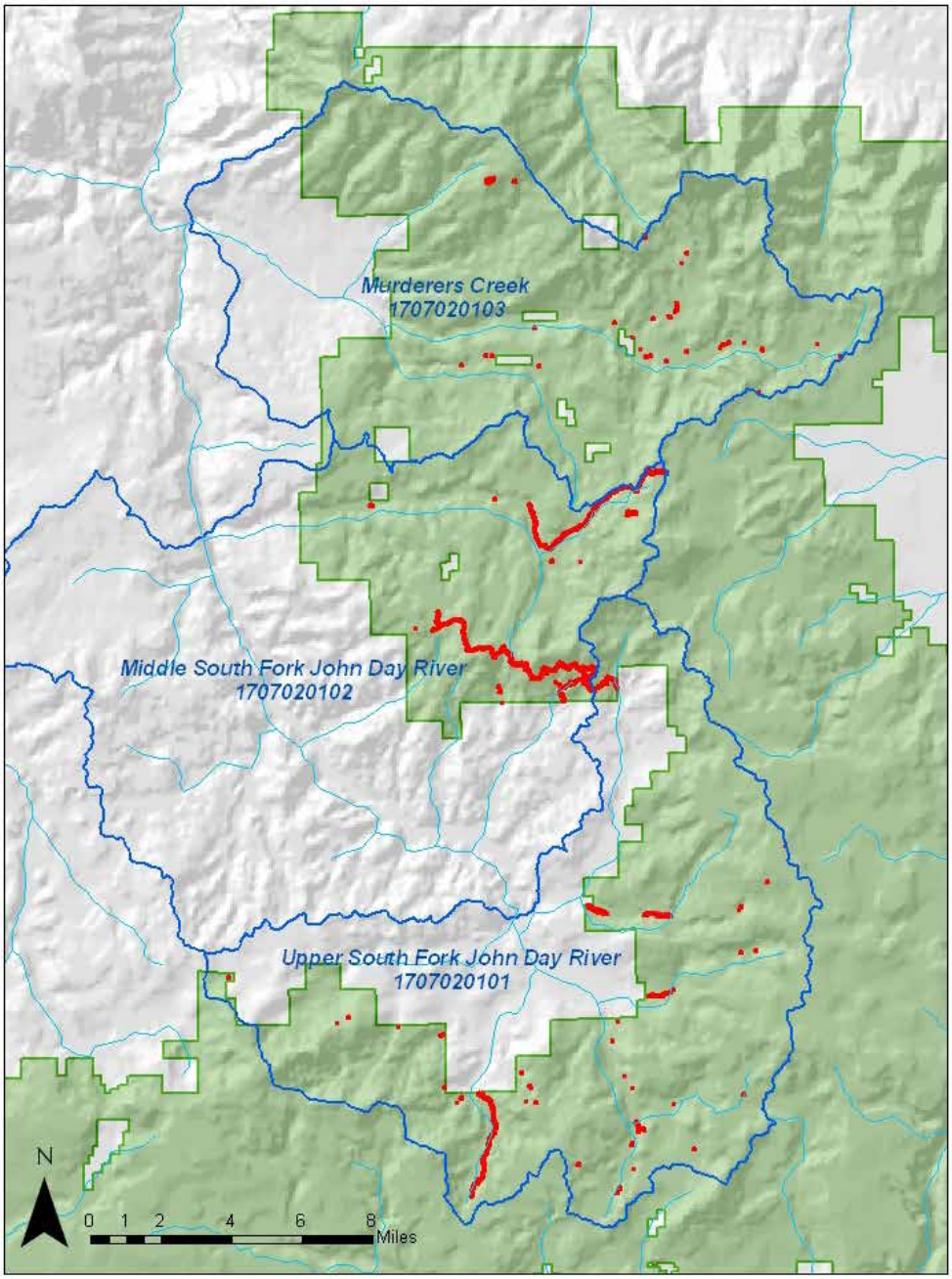
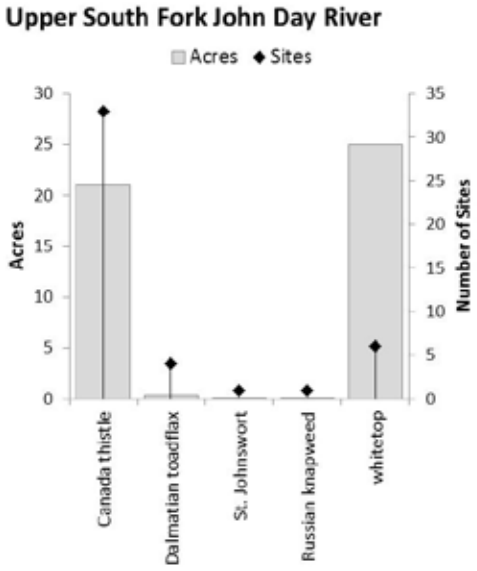


Figure A- 6. Upper John Day Sub-basin - South Fork Portion (17070201)

Upper South Fork John Day River (1707020101)

Ranger district:	Blue Mountain RD, Emigrant Creek RD
County:	Grant, Harney
Total FS acreage:	63,396
Special land uses:	none
Major streams and water bodies:	South Fork John Day River, Bear Creek, Lonesome Creek, Lewis Creek, Spoon Creek
Recreation:	dispersed campsites
Grazing allotments:	Izee, Lonesome, Smoky, Lewis Creek, Snowshoe, Rosebud
Watershed regional priorities:	within Whole Watershed Restoration Initiative (WWRI) Priority Basin (John Day)
Major roads and/or infested roads:	County Road-63, 4700, 3160, 3150, 4785, 6370
TES species of concern:	Calochortus longibarbatus var. peckii (no know invasive plants within 100 ft.)
Comments:	none

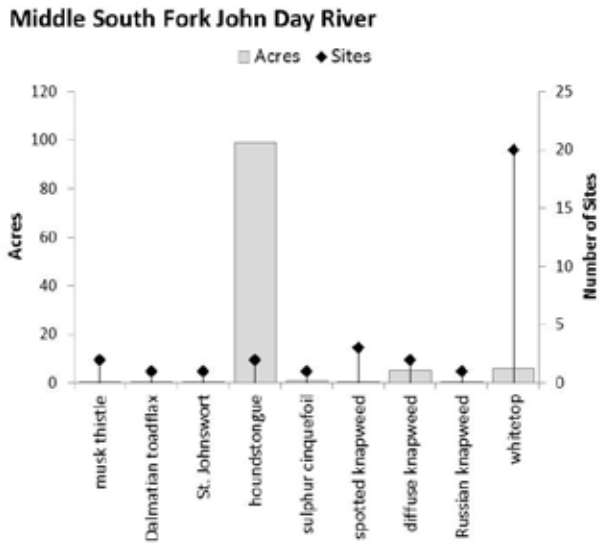


Species	Watershed Total	
	Sites	Acres
Canada thistle	33	21
Dalmatian toadflax	4	0.4
St. Johnswort	1	0.1
Russian knapweed	1	0.1
whitetop	6	25
TOTAL	**45**	**47**

Invasive Species	Within 100 ft. of Stream		Within 25 ft. of Stream		Within 100 ft. of TES Plant		
	Sites	Acres	Sites	Acres	Sites	Distance	TES Species
Canada thistle	20	14	13	10			
Dalmatian toadflax	2	0 .2	1	0 .08			
St. Johnswort	1	0 .1	1	0 .08			
Russian knapweed	1	0 .1					
whitetop	3	2	1	0 .2			
TOTAL	27	18	16	11	0	–	0

Middle South Fork John Day River (1707020102)

Ranger district:	Blue Mountain RD
County:	Grant
Total FS acreage:	34,966
Special land uses:	Murderer's Creek Wild Horse Territory
Major streams and water bodies:	Deer Creek, Buck Creek, Corral Creek, Vester Creek
Recreation:	dispersed campsites
Grazing allotments:	Murderer's Creek, Frenchy, Rosebud, Poison
Watershed regional priorities:	within Whole Watershed Restoration Initiative (WWRI) Priority Basin (John Day)
Major roads and/or infested roads:	2400, 2400-338, 6370, 6370-407
TES species of concern:	steelhead
Comments:	none

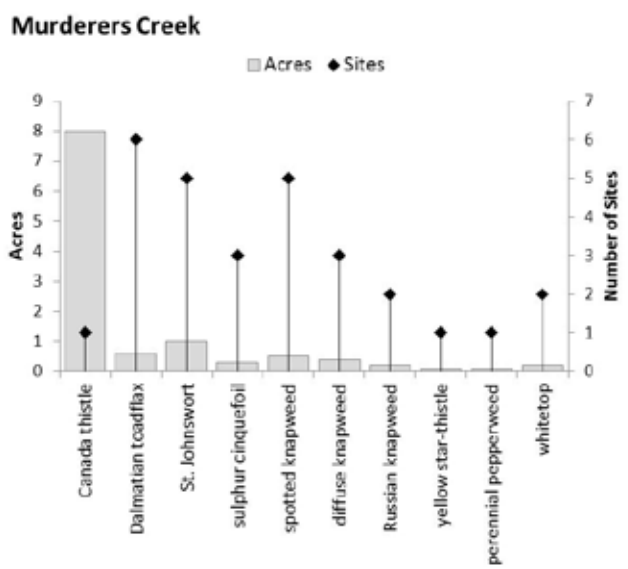


Species	Watershed Total	
	Sites	Acres
musk thistle	2	0.2
Dalmatian toadflax	1	0.1
St. Johnswort	1	0.2
houndstongue	2	99
sulphur cinquefoil	1	0.8
spotted knapweed	3	0.6
diffuse knapweed	2	5
Russian knapweed	1	0.1
whitetop	20	6
TOTAL	**33**	**112**

Invasive Species	Within 100 ft. of Stream		Within 25 ft. of Stream		Within 100 ft. of TES Plant		
	Sites	Acres	Sites	Acres	Sites	Distance	TES Species
musk thistle	1	0 .1	1	0 .1			
houndstongue	2	23	2	1			
sulphur cinquefoil	1	0 .02					
spotted knapweed	1	0 .3	1	0 .2			
whitetop	11	4	10	2			
TOTAL	16	28	14	3	0	–	0

Murderers Creek (1707020103)

Ranger district:	Blue Mountain RD
County:	Grant
Total FS acreage:	65,101
Special land uses:	Shaketable Research Natural Area, Murderer's Creek Wild Horse Territory
Major streams and water bodies:	Murderer's Creek, Tex Creek, South Fork Murderer's Creek, Thorn Creek
Recreation:	Murderer's Creek GS, Deer Creek GS, dispersed campsites
Grazing allotments:	Murderer's Creek, Fields Peak, Aldrich
Watershed regional priorities:	Priority Terrestrial Restoration and Conservation Watershed (TRACS), within Whole Watershed Restoration Initiative (WWRI) Priority Basin (John Day)
Major roads and/or infested roads:	2100, 2160, 2150, 2170, 2180, 2490, 2480
TES species of concern:	steelhead, Luina serpentina (no know invasive plants within 100 ft.), Phacelia minutissima (no know invasive plants within 100 ft.)
Comments:	none



Species	Watershed Total	
	Sites	Acres
Canada thistle	1	8
Dalmatian toadflax	6	0.6
St. Johnswort	5	1
sulphur cinquefoil	3	0.3
spotted knapweed	5	0.5
diffuse knapweed	3	0.4
Russian knapweed	2	0.2
yellow star-thistle	1	0.1
perennial pepperweed	1	0.1
whitetop	2	0.2
TOTAL	**29**	**11**

Invasive Species	Within 100 ft. of Stream		Within 25 ft. of Stream		Within 100 ft. of TES Plant		
	Sites	Acres	Sites	Acres	Sites	Distance	TES Species
Dalmatian toadflax	3	0 .2	2	0 .05			
St. Johnswort	3	0 .2					
spotted knapweed	2	0 .2	2	0 .02			
diffuse knapweed	2	0 .3	2	0 .1			
Russian knapweed	2	0 .1					
yellow star-thistle	1	0 .07					
perennial pepperweed	1	0 .03					
whitetop	1	0 .1	1	0 .03			
TOTAL	15	1	7	0 .2	0	–	0

Upper Malheur Sub-basin – North Fork Portion (17050116)

Upper North Fork Malheur River (1705011611)

Little Malheur River (1705011612)

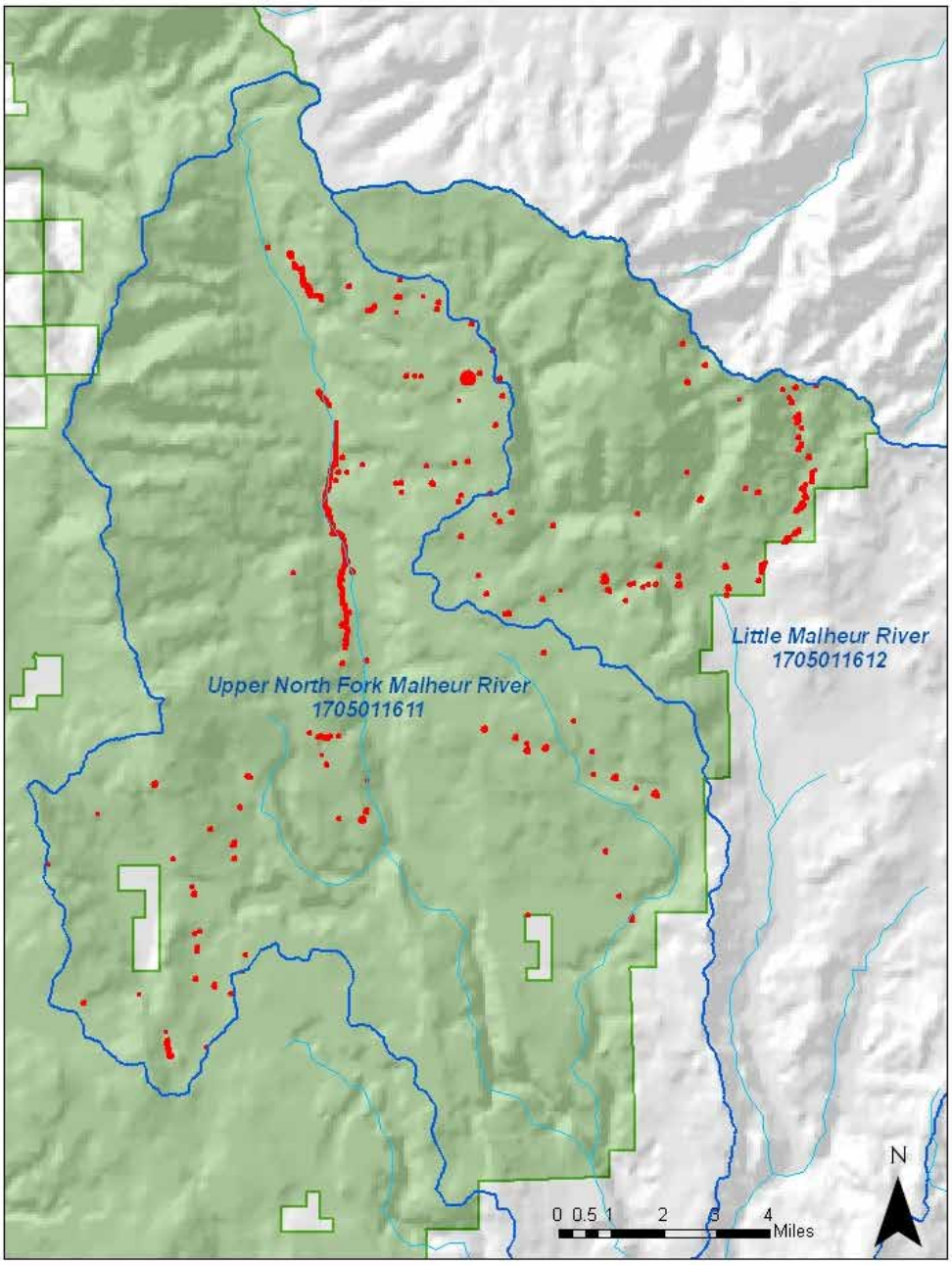
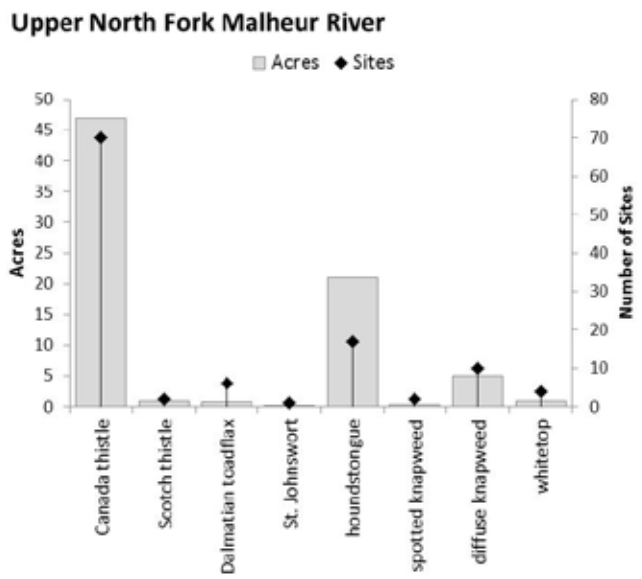


Figure A- 7. Upper Malheur Sub-basin – North Fork Portion (17050116)

Upper North Fork Malheur River (1705011611)

Ranger district:	Prairie City RD
County:	Grant, Baker
Total FS acreage:	96,732
Special land uses:	Monument Rock Wilderness, North Fork Malheur Wild and Scenic River, Dugout Research Natural Area
Major streams and water bodies:	North Fork Malheur River, Crane Creek, Little Crane Creek, Bear Creek, Elk Creek, Flat Creek, Swamp Creek, Spring Creek, Cow Creek, Sheep Creek
Recreation:	Short Creek CG, Elk Creek CG, Little Crane CG, North Fork Malheur CG, Crane Crossing CG, Crane Prairie CG, North Fork TH, Crane Creek TH, Sheep Creek TH, Elf Flat TH, dispersed campsites
Grazing allotments:	Spring Creek, Ott, Flag Prairie, Crane Prairie, North Fork
Watershed regional priorities:	Priority Terrestrial Restoration and Conservation Watershed (TRACS)
Major roads and/or infested roads:	1300, 1400, 1600, 1370, 1675,1665, 1663
TES species of concern:	bull trout
Comments:	Significant groundwater dependent ecosystems throughout watershed

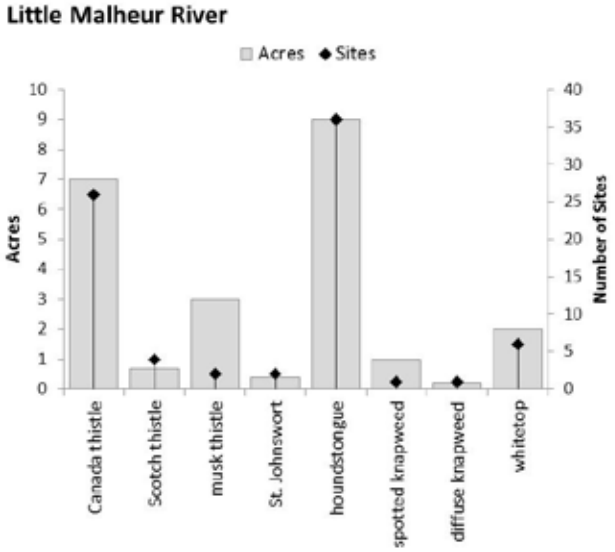


Species	Watershed Total	
	Sites	Acres
Canada thistle	70	47
Scotch thistle	2	1
Dalmatian toadflax	6	0.8
St. Johnswort	1	0.2
houndstongue	17	21
spotted knapweed	2	0.3
diffuse knapweed	10	5
whitetop	4	1
TOTAL	**112**	**76**

Invasive Species	Within 100 ft. of Stream		Within 25 ft. of Stream		Within 100 ft. of TES Plant		
	Sites	Acres	Sites	Acres	Sites	Distance	TES Species
Canada thistle	10	4	7	1			
Scotch thistle	1	0 .09					
Dalmatian toadflax	1	0 .01					
houndstongue	7	2	5	0 .5			
spotted knapweed	1	0 .04					
diffuse knapweed	1	0 .2	1	0 .06			
whitetop	2	0 .2	1	0 .01			
TOTAL	23	7	14	2	0	–	0

Little Malheur River (1705011612)

Ranger district:	Prairie City RD
County:	Grant, Baker, Malheur
Total FS acreage:	31,525
Special land uses:	Monument Rock Wilderness
Major streams and water bodies:	Little Malheur River, Camp Creek, Squaw Creek
Recreation:	Elk Flat Spring CG, Little Malheur TH, Horse Creek TH, Table Rock TH, dispersed campsites
Grazing allotments:	Spring Creek, North Fork, Flag Prairie
Watershed regional priorities:	none
Major roads and/or infested roads:	1600, 1672, 1370
TES species of concern:	none
Comments:	none



Species	Watershed Total	
	Sites	Acres
Canada thistle	26	7
Scotch thistle	4	0.7
musk thistle	2	3
St. Johnswort	2	0.4
houndstongue	36	9
spotted knapweed	1	1
diffuse knapweed	1	0.2
whitetop	6	2
TOTAL	**78**	**23**

Invasive Species	Within 100 ft. of Stream		Within 25 ft. of Stream		Within 100 ft. of TES Plant		
	Sites	Acres	Sites	Acres	Sites	Distance	TES Species
Canada thistle	6	0.6	1	0.1			
Scotch thistle	1	0.2	1	0.06			
musk thistle	1	2	1	0.6			
St. Johnswort	1	0.2	1	0.1			
houndstongue	11	2	5	0.2			
spotted knapweed	1	0.09					
TOTAL	**21**	**5**	**9**	**1**	**0**	**–**	**0**

Upper Malheur Sub-basin – Main Stem Portion (17050116)

Headwaters Malheur River (1705011601)

Wolf Creek (1705011602)

Pine Creek (1705011603)

Otis Creek (1705011606)

Griffin Creek-Upper Malheur River (1705011605)

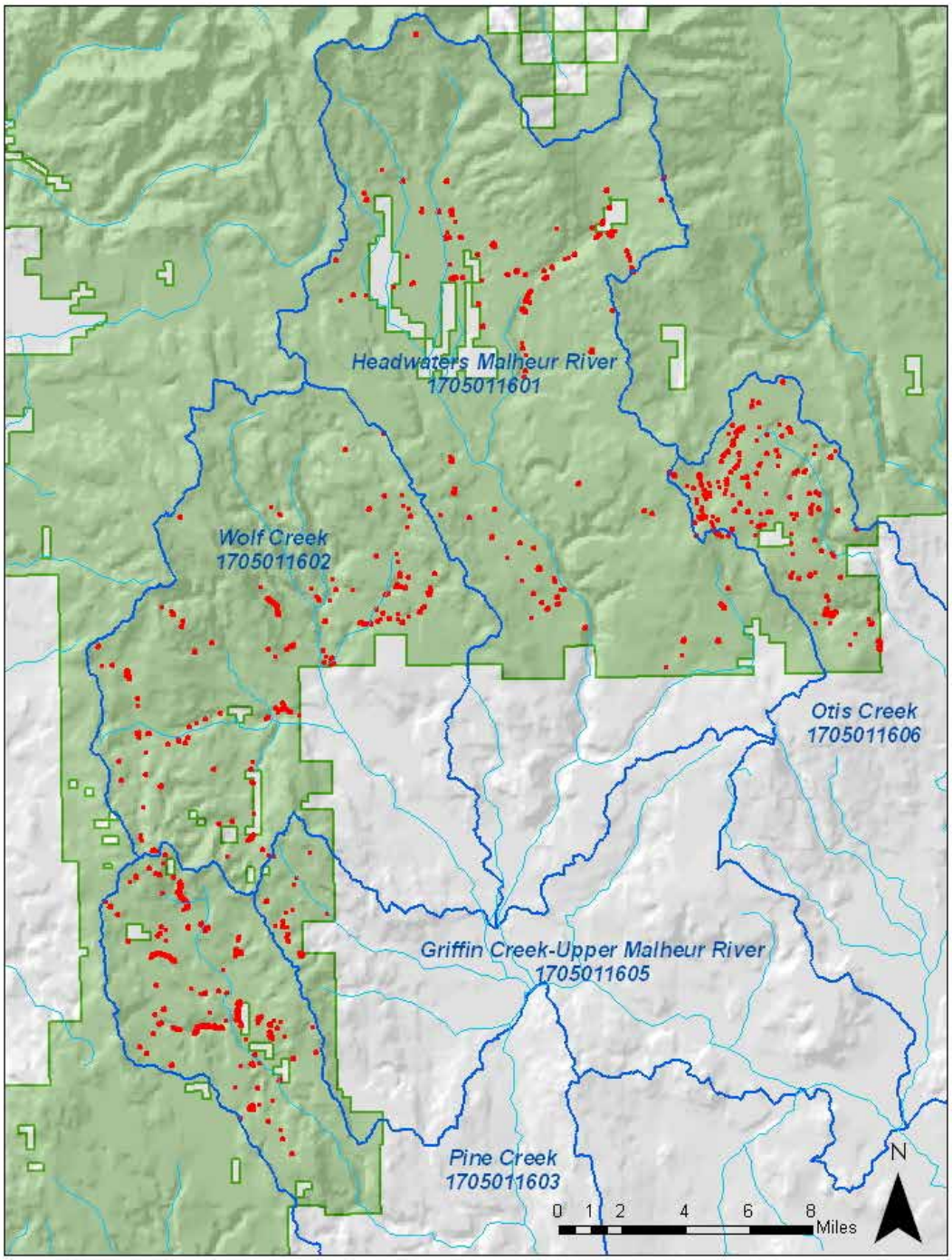
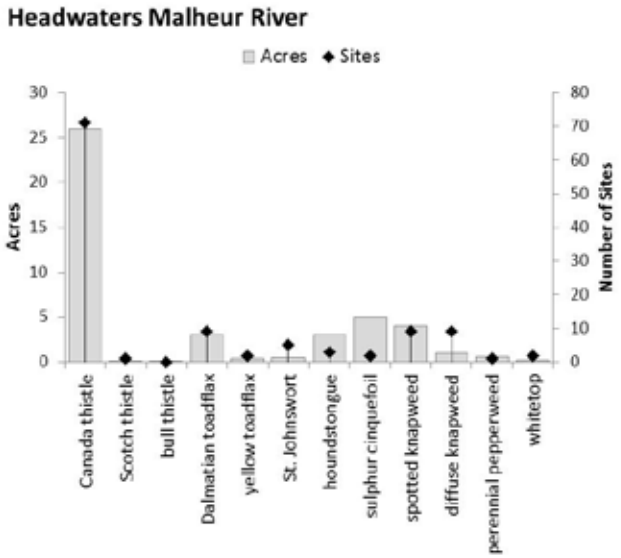


Figure A- 8. Upper Malheur Sub-basin – Main Stem Portion (17050116)

Headwaters Malheur River (1705011601)

Ranger district:	Prairie City RD, Emigrant Creek RD
County:	Grant, Harney
Total FS acreage:	111,947
Special land uses:	Strawberry Mountain Wilderness, Malheur Wild and Scenic River, Fergy Spruce Grove Proposed Botanical Special Interest Area
Major streams and water bodies:	Malheur River, McCoy Creek, Summit Creek, Big Creek, Lake Creek, Crooked Creek, Bosenberg Creek, Mud Lake, Little Mud Lake, High Lake
Recreation:	Big Creek CG, Murray CG, Lake Creek Organizational Camp, Malheur Ford CG, Huddleston SnoPark, Hog Flat TH, Malheur Ford TH, Lake Creek TH, Meadow Fork TH, Big Creek/Snowshoe TH, Skyline TH, Huddleston TH, Starvation TH, dispersed campsites
Grazing allotments:	Summit Prairie, Lake Creek, Logan Valley, McCoy Creek, Dollar Basin, Star Glade, Bluebucket, Central Malheur, Antelope
Watershed regional priorities:	none
Major roads and/or infested roads:	County Road-62, 1600, 1640, 1648, 1649, 1651, 1647, 1643, 1630, 1560, 1400, 1450
TES species of concern:	**bull trout**
Comments:	Significant groundwater dependent ecosystems in Logan Valley

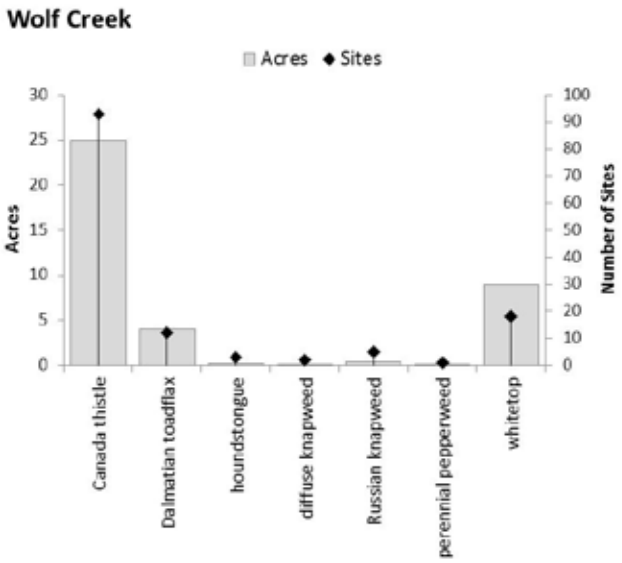


Species	Watershed Total	
	Sites	Acres
Canada thistle	71	26
Scotch thistle	1	0.1
bull thistle	1	0.1
Dalmatian toadflax	9	3
yellow toadflax	2	0.4
St. Johnswort	5	0.5
houndstongue	3	3
sulphur cinquefoil	2	5
spotted knapweed	9	4
diffuse knapweed	9	1
perennial pepperweed	1	0.6
whitetop	2	0.2
TOTAL	**115**	**44**

Invasive Species	Within 100 ft. of Stream		Within 25 ft. of Stream		Within 100 ft. of TES Plant		
	Sites	Acres	Sites	Acres	Sites	Distance	TES Species
Canada thistle	14	2	7	0.6			
Dalmatian toadflax	1	0.3	1	0.1			
yellow toadflax	1	0.2	1	0.1			
St. Johnswort	1	0.1	1	0.006			
sulphur cinquefoil	1	2	1	0.6			
spotted knapweed	3	1	2	0.4			
diffuse knapweed	1	0.02					
whitetop	1	0.1	1	0.02			
TOTAL	**23**	**6**	**14**	**2**	**0**	**–**	**0**

Wolf Creek (1705011602)

Ranger district:	Emigrant Creek RD
County:	Grant, Harney
Total FS acreage:	70,865
Special land uses:	none
Major streams and water bodies:	Wolf Creek, Calamity Creek
Recreation:	Rock Springs CG, dispersed campsites
Grazing allotments:	Antelope, Wolf Mountain, West Malheur, Van, Calamity, Muddy
Watershed regional priorities:	none
Major roads and/or infested roads:	1500, 1700, 1630, 1710, 1712, 1705, 1705-378, 1780, 1550-804
TES species of concern:	none
Comments:	none

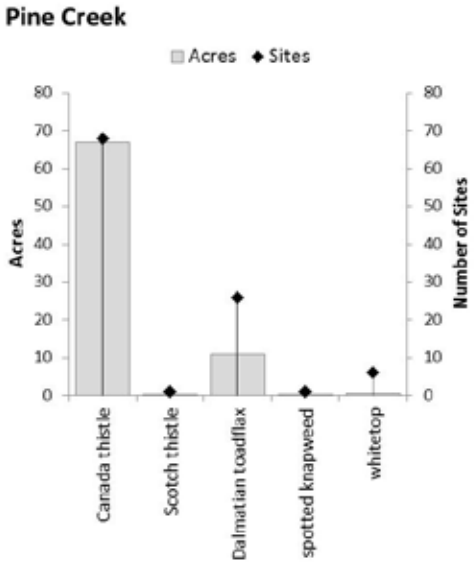


Species	Watershed Total	
	Sites	Acres
Canada thistle	93	25
Dalmatian toadflax	12	4
houndstongue	3	0.2
diffuse knapweed	2	0.1
Russian knapweed	5	0.4
perennial pepperweed	1	0.1
whitetop	18	9
TOTAL	**134**	**39**

Invasive Species	Within 100 ft. of Stream		Within 25 ft. of Stream		Within 100 ft. of TES Plant		
	Sites	Acres	Sites	Acres	Sites	Distance	TES Species
Canada thistle	43	8	30	3			
Dalmatian toadflax	6	1	5	0.3			
Russian knapweed	3	0.2	1	0.001			
perennial pepperweed	1	0.009					
whitetop	8	5	6	1			
TOTAL	**61**	**14**	**42**	**4**	**0**	**–**	**0**

Pine Creek (1705011603)

Ranger district:	Emigrant Creek RD
County:	Harney
Total FS acreage:	32,021
Special land uses:	none
Major streams and water bodies:	Pine Creek
Recreation:	dispersed campsites
Grazing allotments:	Calamity, Alkali, Pine Creek
Watershed regional priorities:	none
Major roads and/or infested roads:	2800, 2850, 2855, 2800-189, 2850-262, 2850-951 (closed), 2850-265 (closed), 2800-336 (closed)
TES species of concern:	none
Comments:	none

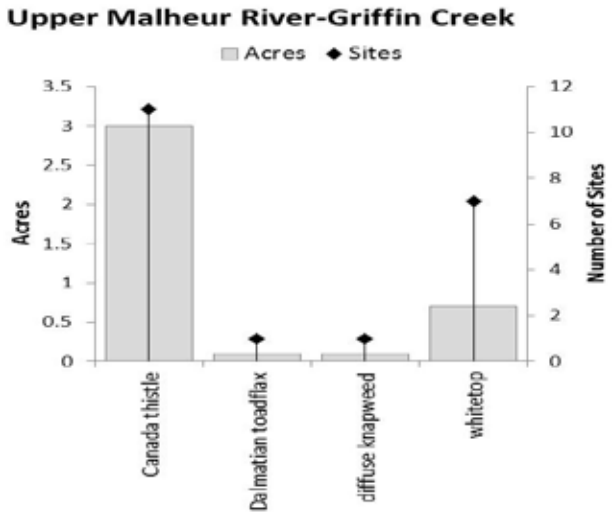


Species	Watershed Total	
	Sites	Acres
Canada thistle	68	67
Scotch thistle	1	0.1
Dalmatian toadflax	26	11
spotted knapweed	1	0.1
whitetop	6	0.6
TOTAL	**102**	**79**

Invasive Species	Within 100 ft. of Stream		Within 25 ft. of Stream		Within 100 ft. of TES Plant		
	Sites	Acres	Sites	Acres	Sites	Distance	TES Species
Canada thistle	19	30	9	10			
Dalmatian toadflax	4	0.7	2	0.1			
TOTAL	**23**	**31**	**11**	**10**	**0**	**–**	**0**

Griffin Creek-Upper Malheur River (1705011605)

Ranger district:	Emigrant Creek RD
County:	Harney
Total FS acreage:	7,343
Special land uses:	none
Major streams and water bodies:	Muddy Creek
Recreation:	dispersed campsites
Grazing allotments:	Muddy, Alkali, Pine Creek
Watershed regional priorities:	none
Major roads and/or infested roads:	1705, 2850, 2850-135
TES species of concern:	none
Comments:	none

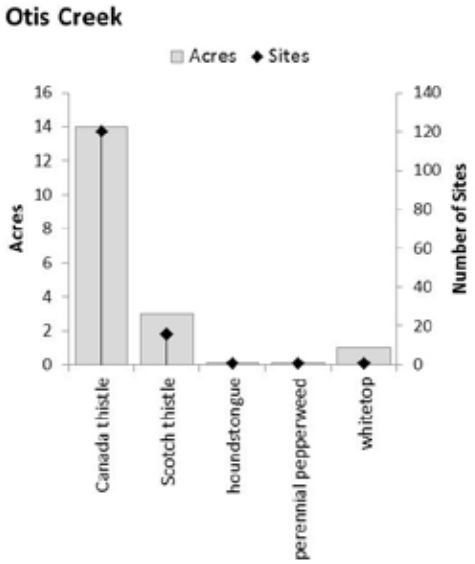


Species	Watershed Total	
	Sites	Acres
Canada thistle	11	3
Dalmatian toadflax	1	0.1
diffuse knapweed	1	0.1
whitetop	7	0.7
TOTAL	**20**	**4**

Invasive Species	Within 100 ft. of Stream		Within 25 ft. of Stream		Within 100 ft. of TES Plant		
	Sites	Acres	Sites	Acres	Sites	Distance	TES Species
Canada thistle	3	2	2	0.5			
whitetop	2	0.2	1	0.1			
TOTAL	**5**	**2**	**3**	**0.6**	**0**	**–**	**0**

Otis Creek (1705011606)

Ranger district:	Prairie City RD
County:	Grant, Harney
Total FS acreage:	20,025
Special land uses:	none
Major streams and water bodies:	Cottonwood Creek
Recreation:	dispersed campsites
Grazing allotments:	Ott, Spring Creek
Watershed regional priorities:	none
Major roads and/or infested roads:	1400, 1420, 1663
TES species of concern:	none
Comments:	none



Species	Watershed Total	
	Sites	Acres
Canada thistle	120	14
Scotch thistle	16	3
houndstongue	1	0.1
perennial pepperweed	1	0.1
whitetop	1	1
TOTAL	**139**	**18**

Invasive Species	Within 100 ft. of Stream		Within 25 ft. of Stream		Within 100 ft. of TES Plant		
	Sites	Acres	Sites	Acres	Sites	Distance	TES Species
Canada thistle	11	0.7	3	0.1			
Scotch thistle	3	1	2	0.6			
perennial pepperweed	1	0.1	1	0.03			
TOTAL	**15**	**2**	**6**	**0.07**	**0**	**–**	**0**

Silvies River Sub-basin (17120002)

Headwaters Silvies River (1712000201)

Bear Creek (1712000202)

Upper Silvies River (1712000203)

Middle Silvies River (1712000204)

Emigrant Creek (1712000205)

Sage Hen Creek (1712000206)

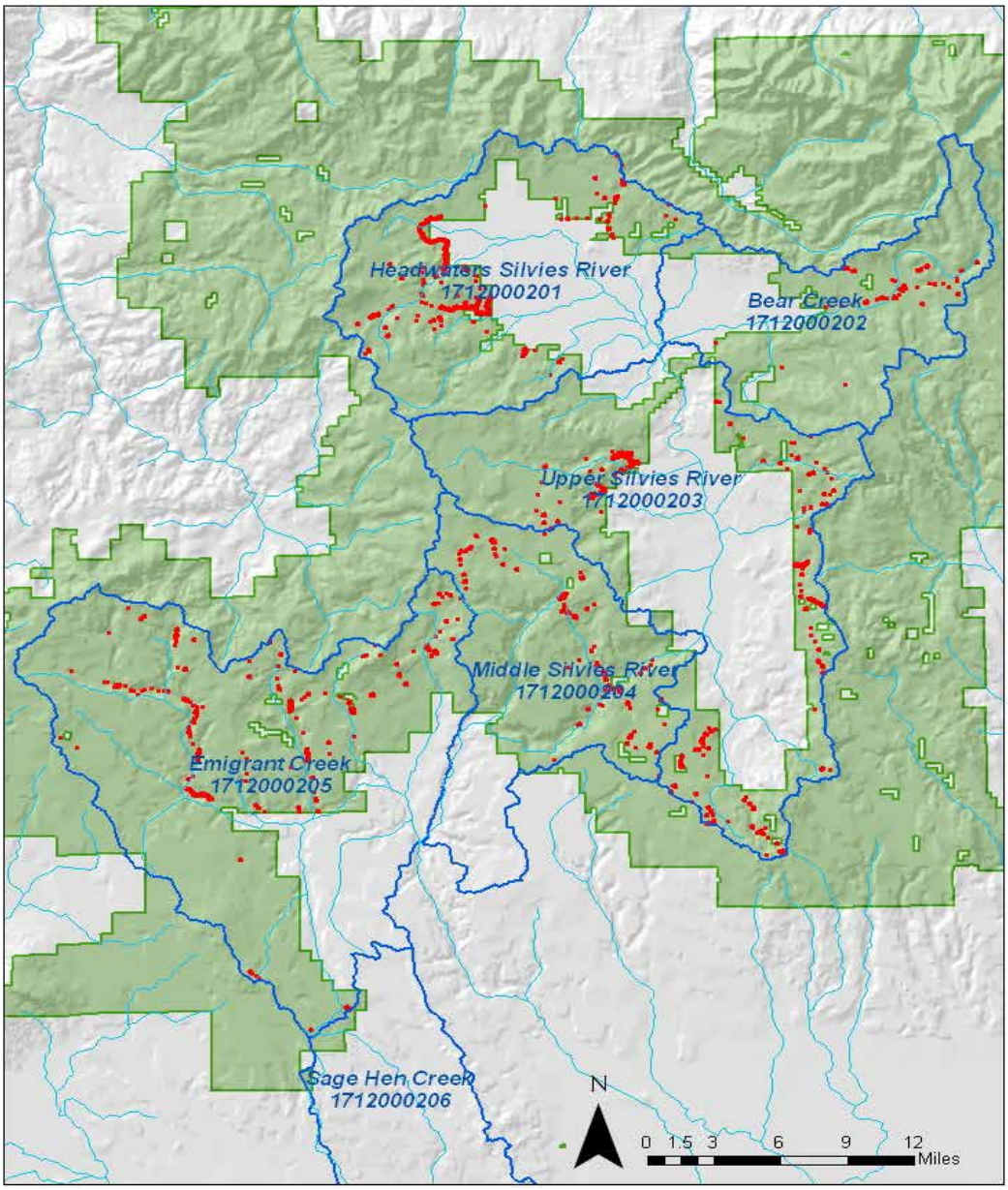
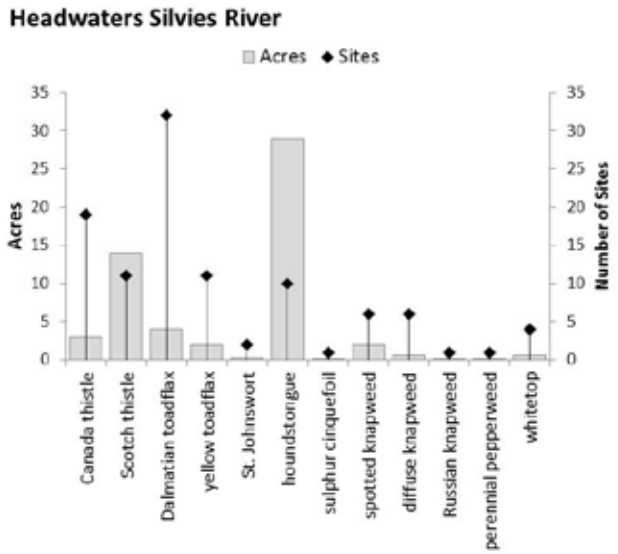


Figure A- 9. Silvies River Sub-basin – 17120002

Headwaters Silvies River (1712000201)

Ranger district:	Blue Mountain RD
County:	Grant
Total FS acreage:	61,343
Special land uses:	none
Major streams and water bodies:	Silvies River, Scotty Creek, Wickiup Creek
Recreation:	Starr Ridge CG, dispersed campsites
Grazing allotments:	Scotty Creek, Jack Creek, Snowshoe, Flagtail, Deadhorse, Hanscomb, Seneca, County Road, Windy Point, Hunter Cabin, Pearson
Watershed regional priorities:	Priority Terrestrial Restoration and Conservation Watershed (TRACS)
Major roads and/or infested roads:	US-395, County Road-63, 2400, 3100, 2100, 4900, 2195, 2400-011, 2400-017, 2400-022, 3780-274, 3780-070 (closed)
TES species of concern:	Botrychium crenulatum, Carex idahoa (no know invasive plants within 100 ft.)
Comments:	none

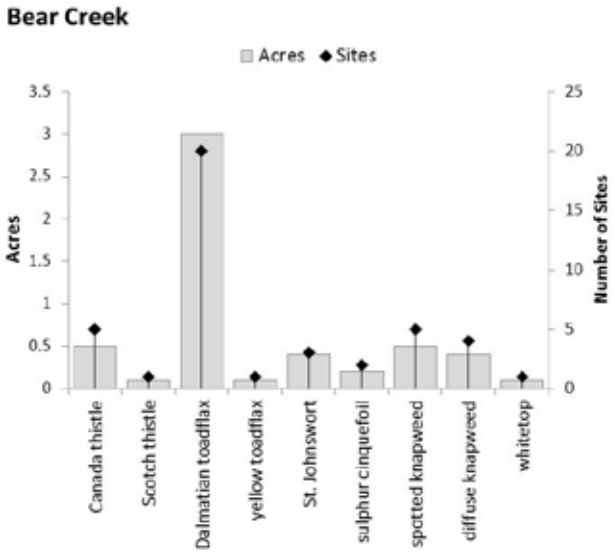


Species	Watershed Total	
	Sites	Acres
Canada thistle	19	3
Scotch thistle	11	14
Dalmatian toadflax	32	4
yellow toadflax	11	2
St. Johnswort	2	0.2
houndstongue	10	29
sulphur cinquefoil	1	0.1
spotted knapweed	6	2
diffuse knapweed	6	0.6
Russian knapweed	1	0.1
perennial pepperweed	1	0.1
whitetop	4	0.6
TOTAL	**104**	**56**

Invasive Species	Within 100 ft. of Stream		Within 25 ft. of Stream		Within 100 ft. of TES Plant		
	Sites	Acres	Sites	Acres	Sites	Distance	TES Species
Canada thistle	9	1	6	0.3	1	54 ft.	*Botrychium crenulatum*
Scotch thistle	2	8	1	2			
Dalmatian toadflax	8	0.6	3	0.2			
yellow toadflax	5	0.6	1	0.0005			
houndstongue	4	9	4	2			
spotted knapweed	1	0.1					
perennial pepperweed	1	0.1	1	0.02			
whitetop	3	0.4	2	0.02			
TOTAL	**33**	**20**	**18**	**4**	**1**	**–**	**1**

Bear Creek (1712000202)

Ranger district:	Blue Mountain RD, Emigrant Creek RD
County:	Grant
Total FS acreage:	52,344
Special land uses:	Strawberry Mountain Wilderness
Major streams and water bodies:	Bear Creek, Antelope Creek
Recreation:	Parish Cabin CG, dispersed campsites
Grazing allotments:	Dark Canyon, Antelope, Wolf Mountain, Bridge Creek, Hunter Cabin
Watershed regional priorities:	none
Major roads and/or infested roads:	1600, 1500, 1601,1619, 1710
TES species of concern:	Carex idahoa (no know invasive plants within 100 ft.), Thelypodium eucosmum (no know invasive plants within 100 ft.)
Comments:	none

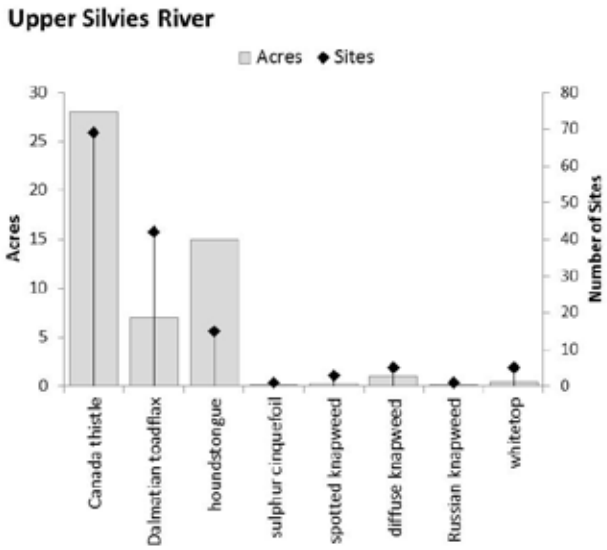


Species	Watershed Total	
	Sites	Acres
Canada thistle	5	0.5
Scotch thistle	1	0.1
Dalmatian toadflax	20	3
yellow toadflax	1	0.1
St. Johnswort	3	0.4
sulphur cinquefoil	2	0.2
spotted knapweed	5	0.5
diffuse knapweed	4	0.4
whitetop	1	0.1
TOTAL	**42**	**5**

Invasive Species	Within 100 ft. of Stream		Within 25 ft. of Stream		Within 100 ft. of TES Plant		
	Sites	Acres	Sites	Acres	Sites	Distance	TES Species
Canada thistle	1	0.09					
Dalmatian toadflax	9	0.3	4	0.2			
St. Johnswort	3	0.1	1	0.002			
sulphur cinquefoil	1	0.02	1	0.04			
diffuse knapweed	2	0.2	1	0.08			
TOTAL	**16**	**0.7**	**7**	**0.3**			

Upper Silvies River (1712000203)

Ranger district:	Emigrant Creek RD, Blue Mountain RD
County:	Grant, Harney
Total FS acreage:	80,687
Special land uses:	none
Major streams and water bodies:	Silvies River, Bridge Creek, Camp Creek, Crooked Creek, Trout Creek
Recreation:	Joaquin Miller CG, dispersed campsites
Grazing allotments:	Scotty Creek, Camp Creek, Koehler, Antelope, Bridge Creek, Silvies, Crooked Creek, House Creek, Calamity, Big Sagehen, Alkali, Devine, Pine Creek
Watershed regional priorities:	none
Major roads and/or infested roads:	US-395, 3700, 2800, 2700, 3935, 2800-021, 3700-843, 3700-115, 3700-841, 3700-855, 3765-932, 3765-868, 3765-912
TES species of concern:	Astragalus tegetarioides, Carex idahoa
Comments:	none

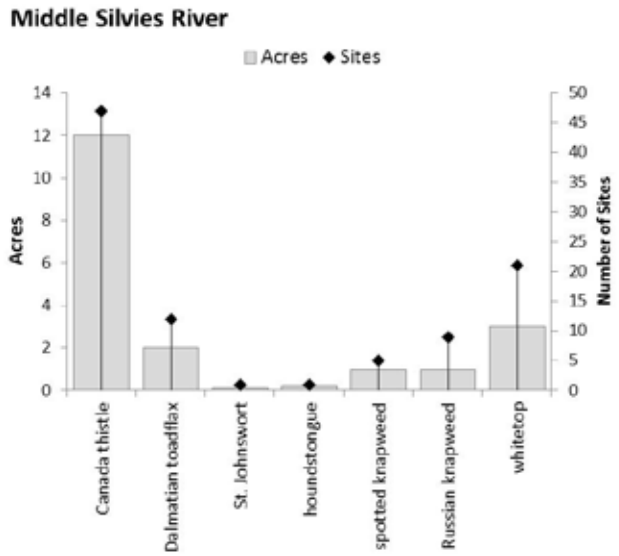


Species	Watershed Total	
	Sites	Acres
Canada thistle	69	28
Dalmatian toadflax	42	7
houndstongue	15	15
sulphur cinquefoil	1	0.1
spotted knapweed	3	0.3
diffuse knapweed	5	1
Russian knapweed	1	0.1
whitetop	5	0.5
TOTAL	**141**	**52**

Invasive Species	Within 100 ft. of Stream		Within 25 ft. of Stream		Within 100 ft. of TES Plant		
	Sites	Acres	Sites	Acres	Sites	Distance	TES Species
Canada thistle	30	11	21	2	1	0 ft.	*Carex idahoa*
Dalmatian toadflax	20	2	4	0.4	3	0 ft.	*Astragalus tegetarioides*
houndstongue	5	6	2	0.7	1	0 ft.	*Carex idahoa*
sulphur cinquefoil	1	0.1	1	0.01			
diffuse knapweed	1	0.3	3	0.1			
Russian knapweed	3	0.03					
whitetop	1	0.1					
TOTAL	**62**	**20**	**31**	**3**	**5**	**–**	**2**

Middle Silvies River (1712000204)

Ranger district:	Emigrant Creek RD
County:	Harney, Grant
Total FS acreage:	61,529
Special land uses:	none
Major streams and water bodies:	Silvies River, Myrtle Creek, Sage Hen Creek
Recreation:	West Myrtle TH, dispersed campsites
Grazing allotments:	Myrtle, Scatfield, Big Sagehen, West Myrtle, Scotty Creek, Crooked Creek, Silvies
Watershed regional priorities:	none
Major roads and/or infested roads:	3100, 3700, 3765, 3130, 3125, 3120, 3140
TES species of concern:	Astragalus tegetarioides, Carex idahoa (no know invasive plants within 100 ft.)
Comments:	none

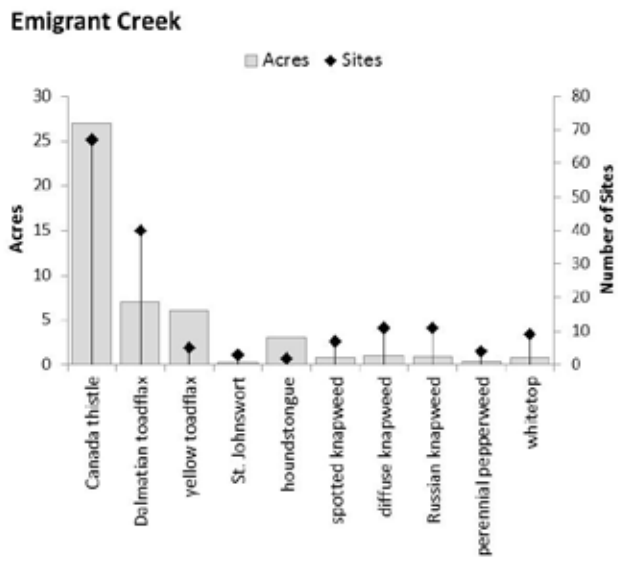


Species	Watershed Total	
	Sites	Acres
Canada thistle	47	12
Dalmatian toadflax	12	2
St. Johnswort	1	0.1
houndstongue	1	0.2
spotted knapweed	5	1
Russian knapweed	9	1
whitetop	21	3
TOTAL	**96**	**19**

Invasive Species	Within 100 ft. of Stream		Within 25 ft. of Stream		Within 100 ft. of TES Plant		
	Sites	Acres	Sites	Acres	Sites	Distance	TES Species
Canada thistle	17	3	9	1			
Dalmatian toadflax	4	1	4	0.2			
spotted knapweed	2	0.02	1	0.006	1	0 ft.	*Astragalus tegetarioides*
Russian knapweed	1	0.07					
whitetop	6	0.4	3	0.1	1	79 ft.	*Astragalus tegetarioides*
TOTAL	**30**	**5**	**17**	**1**	**2**	**–**	**2**

Emigrant Creek (1712000205)

Ranger district:	Emigrant Creek RD
County:	Harney, Grant
Total FS acreage:	130,885
Special land uses:	Stinger Creek Proposed Research Natural Area
Major streams and water bodies:	Emigrant Creek, Hay Creek, Yellowjacket Creek, Sawtooth Creek, Whisky Creek, Crowsfoot Creek, Yellowjacket Lake
Recreation:	Yellow Jacket CG, Emigrant CG, Falls CG, Pendleton Spring CG, Alder Springs CG, Donnelly CG, dispersed campsites
Grazing allotments:	Rainbow, West Myrtle, Sawtooth, Blue Creek, Hughet Valley, Snow Mountain, Allison, Donnelly, Green Butte
Watershed regional priorities:	none
Major roads and/or infested roads:	3700, 4700, 4300, 4100, 3746, 3745, 3740, 4780, 4781, 4770, 4357, 4360, 4356, 4370, 4341, 4340, 4334, 4335, 4320, 4332, 4140
TES species of concern:	Calochortus longibarbatus var. peckii
Comments:	none

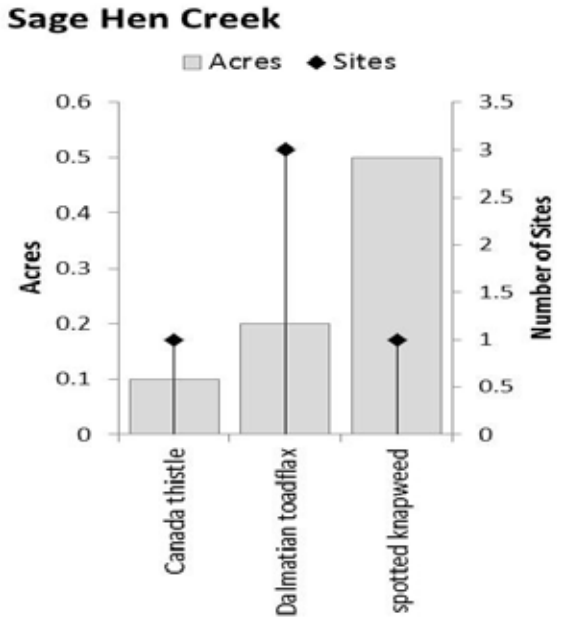


Species	Watershed Total	
	Sites	Acres
Canada thistle	67	27
Dalmatian toadflax	40	7
yellow toadflax	5	6
St. Johnswort	3	0.3
houndstongue	2	3
spotted knapweed	7	0.8
diffuse knapweed	11	1
Russian knapweed	11	0.9
perennial pepperweed	4	0.4
whitetop	9	0.8
TOTAL	**159**	**47**

Invasive Species	Within 100 ft. of Stream		Within 25 ft. of Stream		Within 100 ft. of TES Plant		
	Sites	Acres	Sites	Acres	Sites	Distance	TES Species
Canada thistle	28	6	12	0.9			
Dalmatian toadflax	15	0.8	3	0.1			
yellow toadflax	3	2	3	0.6	3	0 ft.	*Calochortus longibarbatus* var. *peckii*
spotted knapweed	3	0.2	2	0.08			
diffuse knapweed	3	0.2	2	0.1			
Russian knapweed	3	0.1	1	0.05			
perennial pepperweed	2	0.06					
whitetop	4	0.3	2	0.1			
TOTAL	**61**	**10**	**25**	**2**	**3**	**–**	**1**

Sage Hen Creek (1712000206)

Ranger district:	Emigrant Creek RD
County:	Harney
Total FS acreage:	2,075
Special land uses:	none
Major streams and water bodies:	none
Recreation:	dispersed campsites
Grazing allotments:	Donnelly
Watershed regional priorities:	none
Major roads and/or infested roads:	County Road-127, 4100
TES species of concern:	none
Comments:	none



Species	Watershed Total	
	Sites	Acres
Canada thistle	1	0.1
Dalmatian toadflax	3	0.2
spotted knapweed	1	0.5
TOTAL	**5**	**1**

Invasive Species	Within 100 ft. of Stream		Within 25 ft. of Stream		Within 100 ft. of TES Plant		
	Sites	Acres	Sites	Acres	Sites	Distance	TES Species
None							
TOTAL	**0**	**0**	**0**	**0**	**0**	**–**	**0**

Silver Creek Sub-basin (17120004)

Claw Creek (1712000401)

Upper Silver Creek (1712000402)

Middle Silver Creek (1712000403)

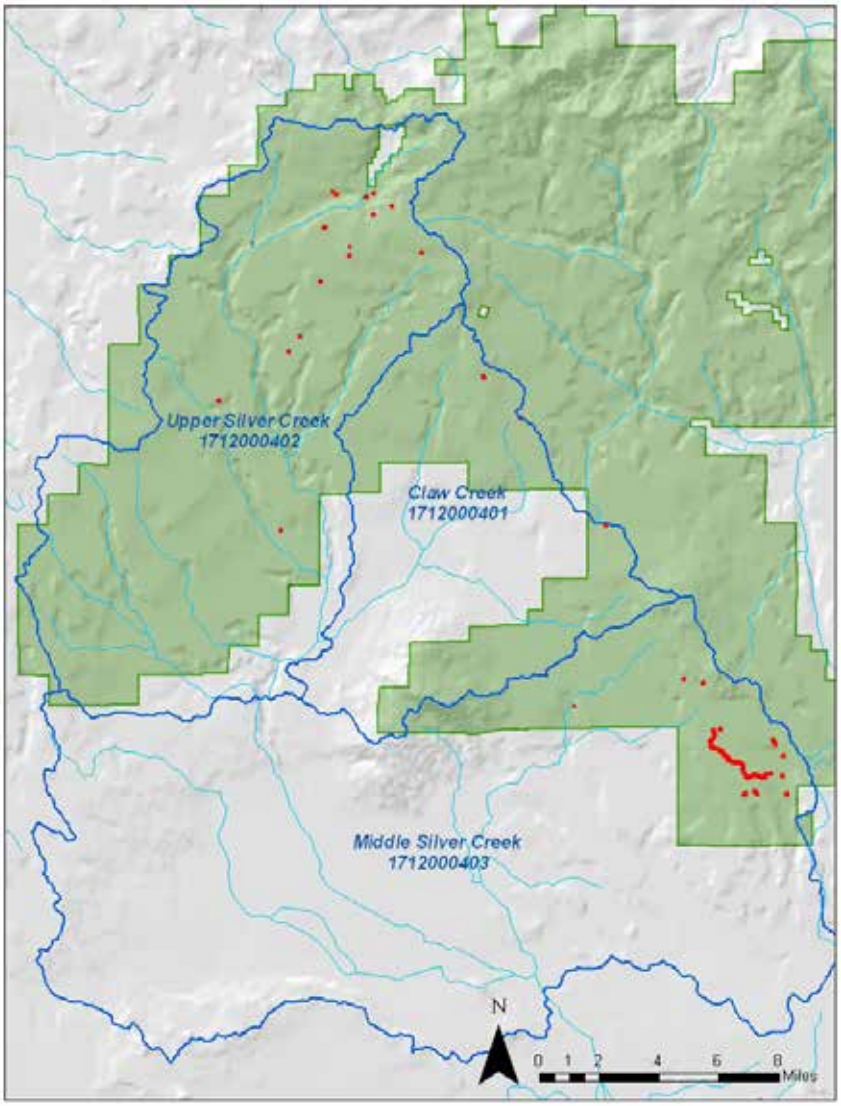
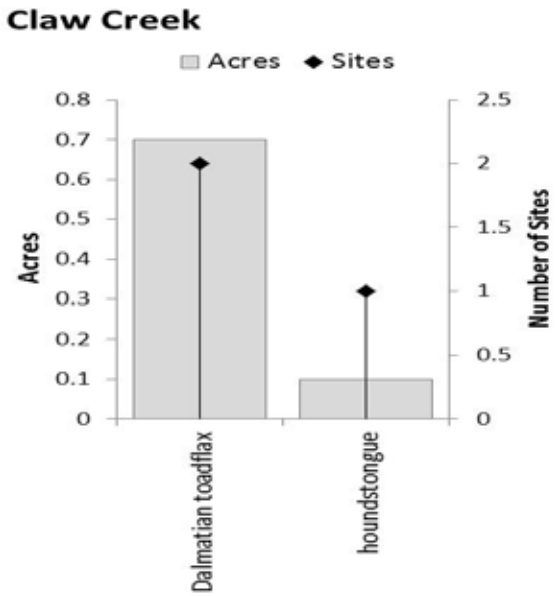


Figure A- 10. Silver Creek Sub-basin (17120004)

Claw Creek (1712000401)

Ranger district:	Emigrant Creek RD
County:	Harney
Total FS acreage:	29,620
Special land uses:	Dry Mountain Research Natural Area
Major streams and water bodies:	Wickiup Creek, Claw Creek
Recreation:	dispersed campsites
Grazing allotments:	Silver Creek, Donnelly, Green Butte
Watershed regional priorities:	none
Major roads and/or infested roads:	4100, 4335, 4130
TES species of concern:	Astragalus tegetarioides (no know invasive plants within 100 ft.)
Comments:	none

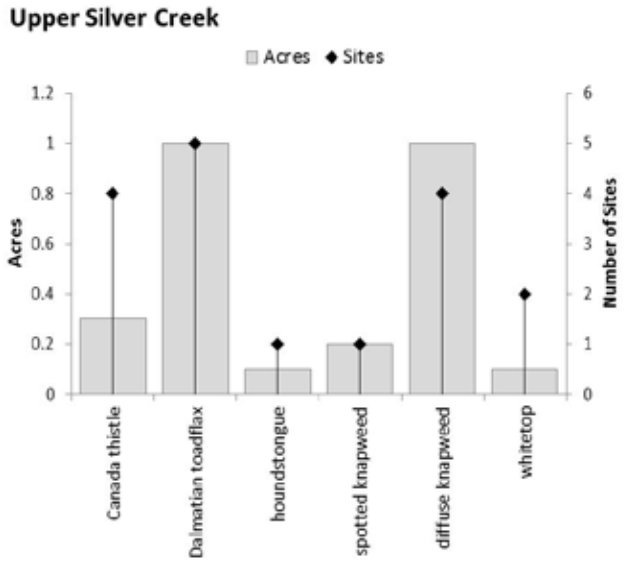


Species	Watershed Total	
	Sites	Acres
Dalmatian toadflax	2	0.7
houndstongue	1	0.1
TOTAL	**3**	**1**

Invasive Species	Within 100 ft. of Stream		Within 25 ft. of Stream		Within 100 ft. of TES Plant		
	Sites	Acres	Sites	Acres	Sites	Distance	TES Species
None							
TOTAL	**0**	**0**	**0**	**0**	**0**	**–**	**0**

Upper Silver Creek (1712000402)

Ranger district:	Emigrant Creek RD
County:	Harney, Crook
Total FS acreage:	96,071
Special land uses:	Silver Creek Proposed Research Natural Area
Major streams and water bodies:	Silver Creek, Sawmill Creek, Nicoll Creek, Delintment Creek, Delintment Lake
Recreation:	Buck Springs CG, Tip Top Spring CG, Delintment Lake CG, dispersed campsites
Grazing allotments:	Allison, Silver Creek, Sawmill, Buck Mountain, Lower Nicoll
Watershed regional priorities:	none
Major roads and/or infested roads:	4100, 4500, 4170, 4160, 4175, 4161, 4545, 4535, 4510, 4525
TES species of concern:	Astragalus tegetarioides (no know invasive plants within 100 ft.), Calochortus longibarbatus var. peckii (no know invasive plants within 100 ft.)
Comments:	none

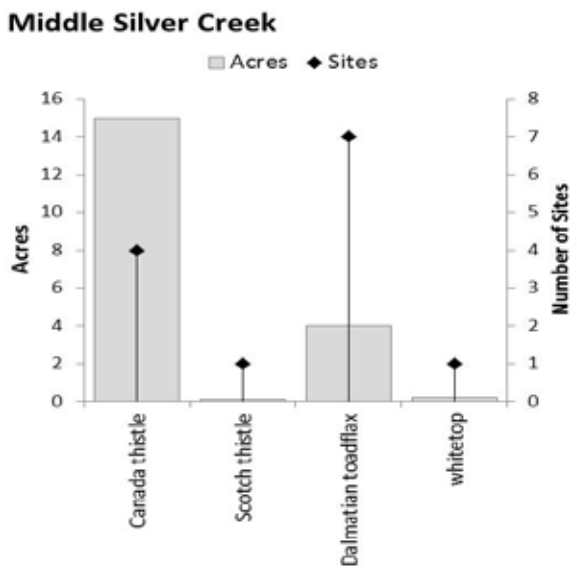


Species	Watershed Total	
	Sites	Acres
Canada thistle	4	0.3
Dalmatian toadflax	5	1
houndstongue	1	0.1
spotted knapweed	1	0.2
diffuse knapweed	4	1
whitetop	2	0.1
TOTAL	**17**	**3**

Invasive Species	Within 100 ft. of Stream		Within 25 ft. of Stream		Within 100 ft. of TES Plant		
	Sites	Acres	Sites	Acres	Sites	Distance	TES Species
Canada thistle	1	0.04	1	0.0003			
Dalmatian toadflax	1	.09					
whitetop	1	.04					
TOTAL	**3**	**0.2**	**1**	**0.0003**	**0**	**–**	**0**

Middle Silver Creek (1712000403)

Ranger district:	Emigrant Creek RD
County:	Harney
Total FS acreage:	28,376
Special land uses:	Dry Mountain Research Natural Area
Major streams and water bodies:	none
Recreation:	Pine Springs Overlook, dispersed campsites
Grazing allotments:	Green Butte, Donnelly
Watershed regional priorities:	none
Major roads and/or infested roads:	4100, 4107, 4120, 4126
TES species of concern:	Astragalus tegetarioides (no know invasive plants within 100 ft.)
Comments:	none



Species	Watershed Total	
	Sites	Acres
Canada thistle	4	15
Scotch thistle	1	0.1
Dalmatian toadflax	7	4
whitetop	1	0.2
TOTAL	**13**	**19**

Invasive Species	Within 100 ft. of Stream		Within 25 ft. of Stream		Within 100 ft. of TES Plant		
	Sites	Acres	Sites	Acres	Sites	Distance	TES Species
Canada thistle	2	0.2					
Scotch thistle	1	0.1					
Dalmatian toadflax	1	0.2					
TOTAL	**4**	**0.5**	**0**	**0**	**0**	**–**	**0**

Harney-Malheur Lakes Sub-basin (17120001)

North Basin (1712000101)

Malheur Slough (1712000102)

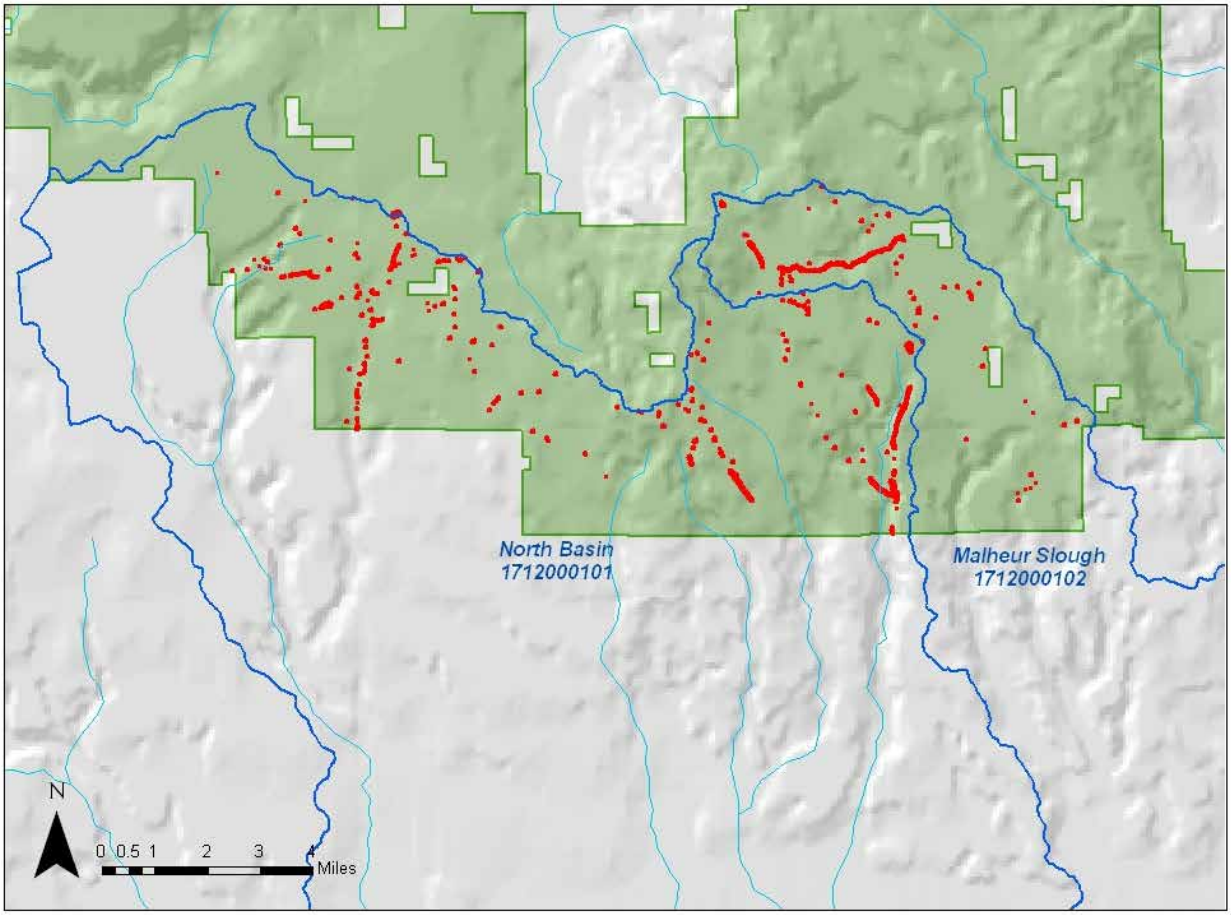
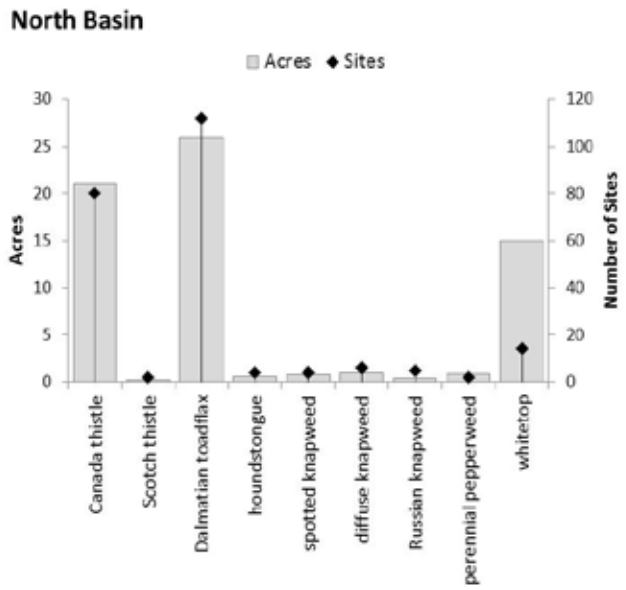


Figure A- 11. Harney-Malheur Lakes Sub-basin (17120001)

North Basin (1712000101)

Ranger district:	Emigrant Creek RD
County:	Harney
Total FS acreage:	32,979
Special land uses:	none
Major streams and water bodies:	Rattlesnake Creek, Poison Creek
Recreation:	Idlewild CG, dispersed campsites
Grazing allotments:	Myrtle, Devine, Pine Creek
Watershed regional priorities:	none
Major roads and/or infested roads:	US-395, 2800, 2800-480, 2810, 2810-478, 2810-482 (closed), 2820, 2820-216, 2820-028, 3935, 3900-958,
TES species of concern:	Astragalus tegetarioides
Comments:	none

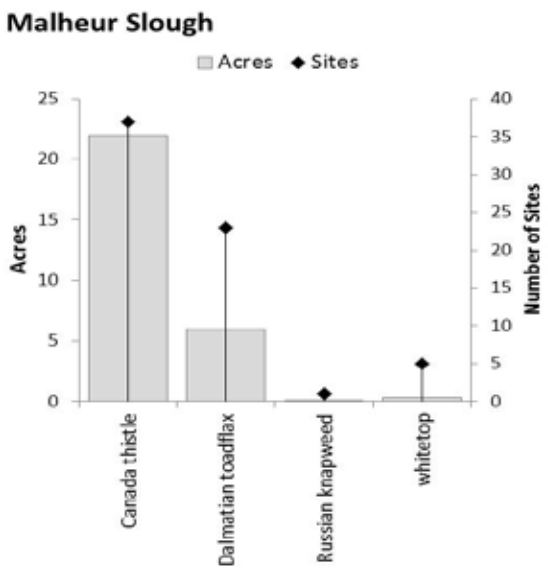


Species	Watershed Total	
	Sites	Acres
Canada thistle	80	21
Scotch thistle	2	0.2
Dalmatian toadflax	112	26
houndstongue	4	0.6
spotted knapweed	4	0.8
diffuse knapweed	6	1
Russian knapweed	5	0.4
perennial pepperweed	2	0.9
whitetop	14	15
TOTAL	**229**	**66**

Invasive Species	Within 100 ft. of Stream		Within 25 ft. of Stream		Within 100 ft. of TES Plant		
	Sites	Acres	Sites	Acres	Sites	Distance	TES Species
Canada thistle	14	7	9	2			
Dalmatian toadflax	30	3	14	0.3	1	0 ft.	*Astragalus tegetarioides*
houndstongue	4	0.5	2	0.07			
spotted knapweed	1	0.03	1	0.02			
diffuse knapweed	3	0.2	1	0.02			
Russian knapweed	2	0.2	1	0.03			
whitetop	6	5	3	0.4			
TOTAL	**60**	**16**	**31**	**3**	**1**	**–**	**1**

Malheur Slough (1712000102)

Ranger district:	Emigrant Creek RD
County:	Harney
Total FS acreage:	13,732
Special land uses:	none
Major streams and water bodies:	Cow Creek
Recreation:	Call Meadows SnoPark, dispersed campsites
Grazing allotments:	Pine Creek
Watershed regional priorities:	none
Major roads and/or infested roads:	2800, 2820, 2810, 2850, 2830, 2815, 2820-499, 2815-700
TES species of concern:	none
Comments:	none



Species	Watershed Total	
	Sites	Acres
Canada thistle	37	22
Dalmatian toadflax	23	6
Russian knapweed	1	0.1
whitetop	5	0.3
TOTAL	**66**	**28**

Invasive Species	Within 100 ft. of Stream		Within 25 ft. of Stream		Within 100 ft. of TES Plant		
	Sites	Acres	Sites	Acres	Sites	Distance	TES Species
Canada thistle	2	0.2	2	0.04			
TOTAL	**2**	**0.2**	**2**	**0.04**	**0**	**–**	**0**

Deschutes River Basin (170703)

South Fork Beaver Creek (1707030305)

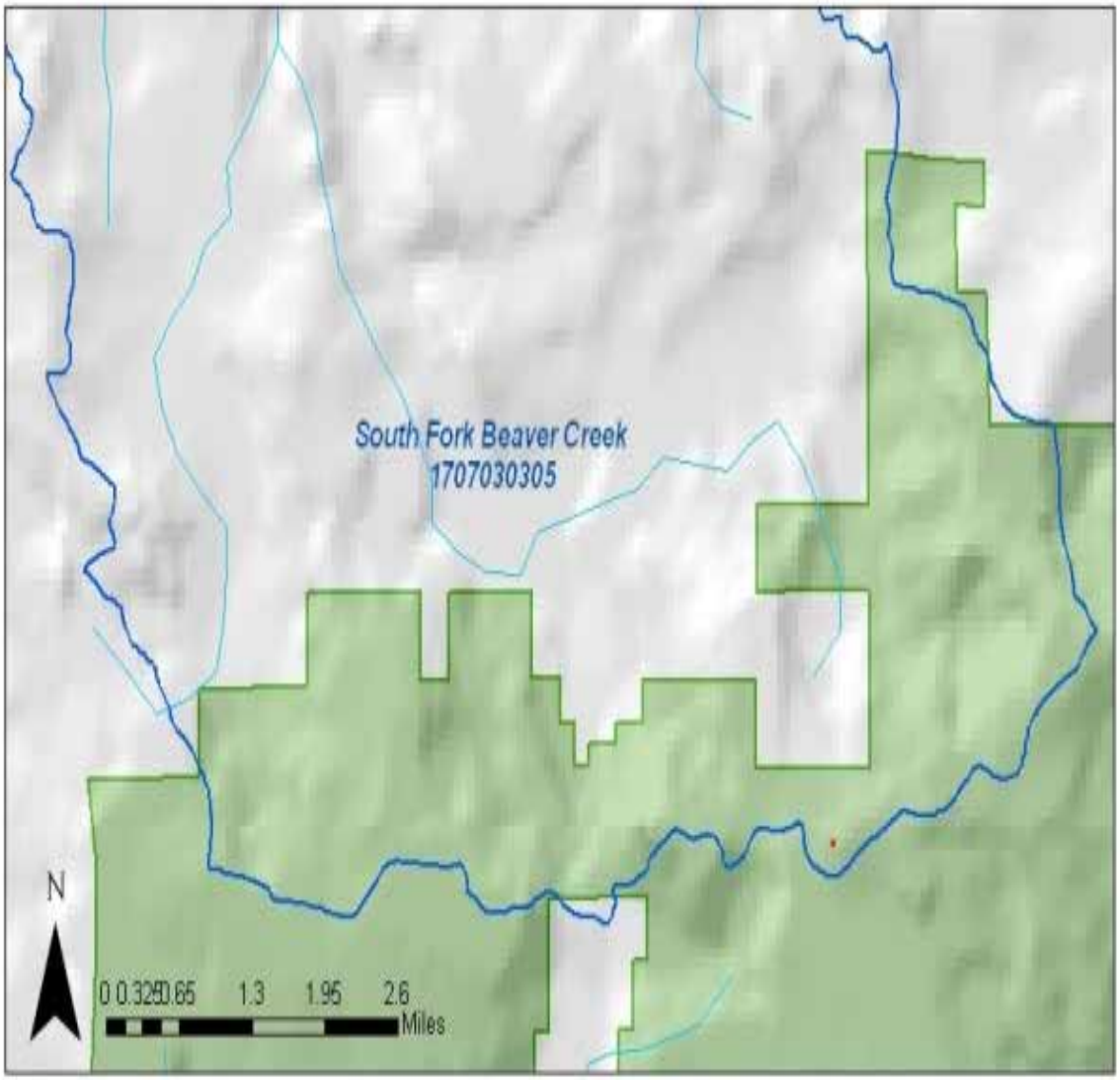
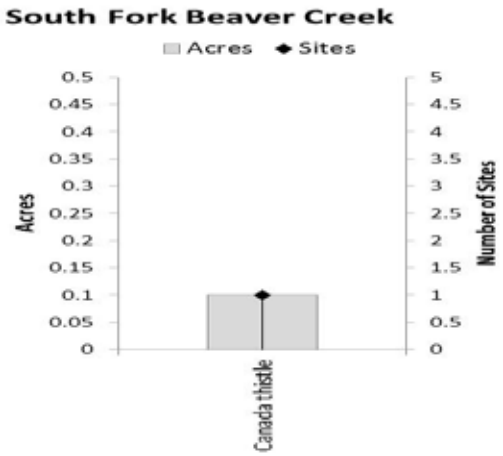


Figure A- 12. Deschutes River Basin (170703), South Fork Beaver Creek (1707030305)

South Fork Beaver Creek (1707030305)

Ranger district:	Emigrant Creek RD
County:	Harney, Grant
Total FS acreage:	7,428
Special land uses:	none
Major streams and water bodies:	Freeman Creek
Recreation:	dispersed campsites
Grazing allotments:	Sawmill, Allison, Little Mowich
Watershed regional priorities:	none
Major roads and/or infested roads:	4100
TES species of concern:	none
Comments:	none



Species	Watershed Total	
	Sites	Acres
Canada thistle	1	0.1
TOTAL	**1**	**0.1**

Invasive Species	Within 100 ft. of Stream		Within 25 ft. of Stream		Within 100 ft. of TES Plant		
	Sites	Acres	Sites	Acres	Sites	Distance	TES Species
None							
TOTAL	**0**	**0**	**0**	**0**	**0**	**–**	**0**