Draft Programmatic Environmental Impact Statement for

Vegetation Treatments Using Aminopyralid, Fluroxypyr, and Rimsulfuron

on Bureau of Land Management Lands in 17 Western States

April 2015

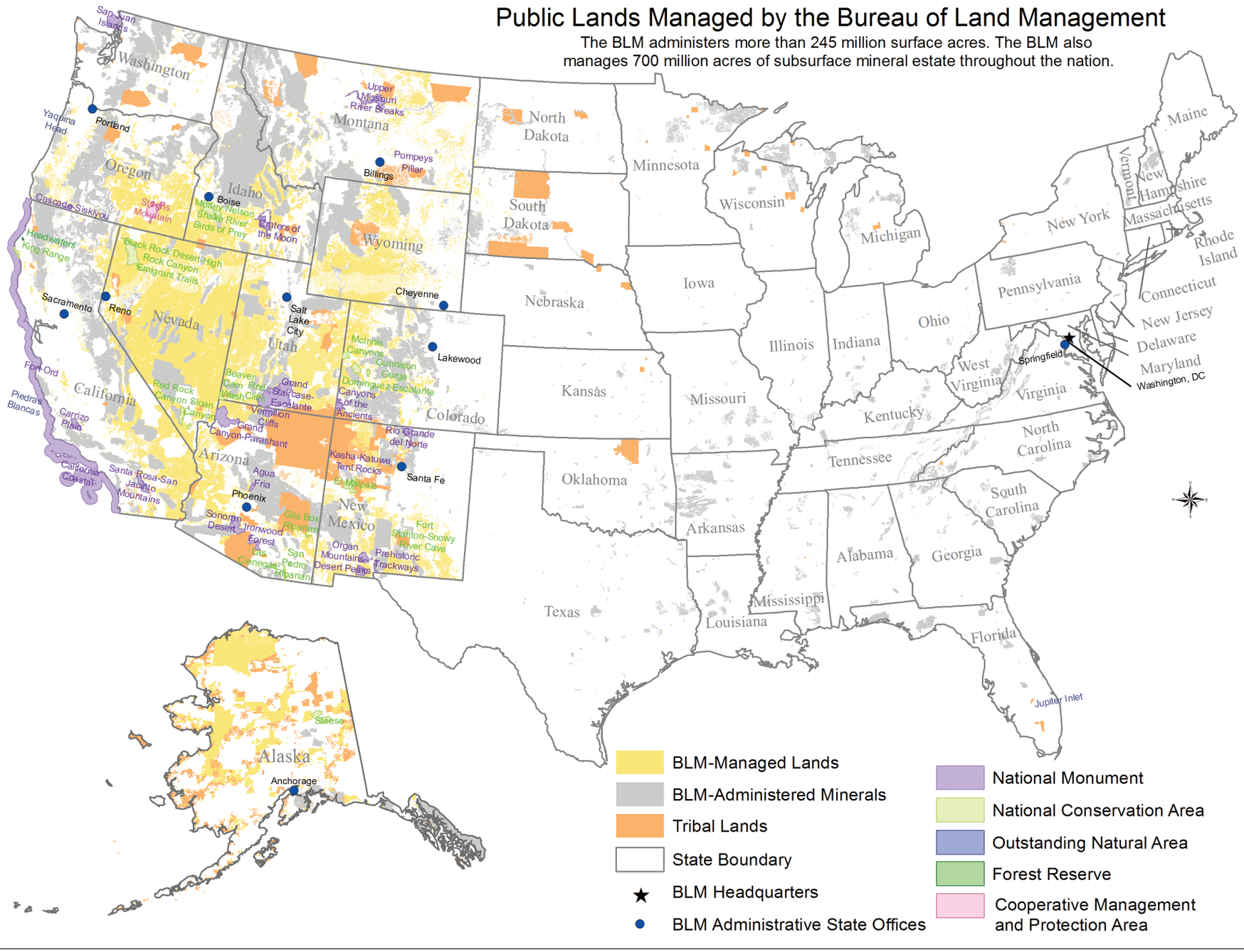
BLM

U.S. Department of the Interior
Bureau of Land Management

DOI-BLM-WO-WO2100-2012-0002-EIS

Public Lands Managed by the Bureau of Land Management

The BLM administers more than 245 million surface acres. The BLM also manages 700 million acres of subsurface mineral estate throughout the nation.



United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Washington, DC 20240
http://www.blm.gov

Dear Reader:

Enclosed for your review and comment is the *Draft Vegetation Treatments Using Aminopyralid, Fluroxypyr, and Rimsulfuron on Bureau of Land Management Lands in 17 Western States Programmatic Environmental Impact Statement* (PEIS). This document assesses, on a national level, the Bureau of Land Management's (BLM's) use of the active ingredients aminopyralid, fluroxypyr, and rimsulfuron. If approved, these three herbicides would be added to the BLM's list of 18 approved active ingredients and integrated into the vegetation management program that was analyzed in a PEIS released in 2007.

Alternatives analyzed in the draft PEIS include the No Action Alternative, or a continuation of use of 18 currently approved herbicides. In addition, three action alternatives were evaluated: 1) the Preferred Alternative, which would allow the BLM to use aminopyralid, fluroxypyr, and rimsulfuron in addition to the currently approved herbicides; 2) an alternative that would prohibit aerial spraying of the three new herbicides; and 3) an alternative that would only allow the BLM to add the two new herbicides without acetolactate synthase-inhibiting active ingredients (aminopyralid and fluroxypyr). Under all alternatives (including the No Action Alternative), projected maximum total use of herbicides would be the same, at 932,000 acres annually.

The Draft PEIS details the expected impacts and benefits from the BLM's use of herbicides, and provides analyses to determine which herbicide active ingredients will be approved for use on public lands administered by the BLM in the Western United States, including Alaska.

We appreciate any comments and public discussions that will help us develop the Final PEIS. As required by the National Environmental Policy Act, we have submitted copies of the Draft PEIS to the Environmental Protection Agency. Comments can be submitted to the BLM throughout the 45-day comment period. If you have any questions regarding this document, please contact Gina Ramos, WO-220 at (202) 912-7226. Comments on the Draft PEIS should be sent to:

Ms. Gina Ramos
PEIS Project Manager
Bureau of Land Management
1849 C Street NW, Rm 2134 LM, WO-220
Washington, DC 20240
E-Mail: blm_wo_vegeis@blm.gov
Fax: (202) 912-7182

Edwin Roberson
Assistant Director
Resources and Planning

DRAFT

PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT VEGETATION TREATMENTS USING AMINOPYRALID, FLUROXYPYR, AND RIMSULFURON ON BUREAU OF LAND MANAGEMENT LANDS IN 17 WESTERN STATES

(X) DRAFT

( ) FINAL

LEAD AGENCY:

U.S. Department of the Interior
Bureau of Land Management
Washington Office, Washington, D.C.

PROJECT LOCATION:

Alaska, Arizona, California, Colorado, Idaho, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, Oregon, Texas, South Dakota, Utah, Washington, and Wyoming

COMMENTS ON THIS DRAFT PROGRAMMATIC EIS SHOULD BE DIRECTED TO:

Ms. Gina Ramos
PEIS Project Manager
Bureau of Land Management
1849 C Street, NW Rm 2134 LM, WO-220
Washington, DC 20240
(206) 623-3793-FAX
Email: blm_wo_vegeis@blm.gov

DATE BY WHICH COMMENTS ON THE EIS MUST BE POSTMARKED TO THE BLM:

45 Days after Publication of the EIS Notice of Availability in the Federal Register

ABSTRACT

This Draft Programmatic Environmental Impact Statement (PEIS) analyzes the potential direct, indirect, and cumulative impacts associated with the Bureau of Land Management's use of the herbicides aminopyralid, fluroxypyr, and rimsulfuron on the human and natural environment. These three herbicides would be added to the BLM's list of approved active ingredients and integrated into the vegetation management program that was analyzed in an earlier PEIS released in 2007. Alternatives analyzed in the PEIS include the No Action Alternative, or a continuation of use of 18 currently approved herbicides. In addition, three action alternatives were evaluated: 1) the Preferred Alternative, which would allow the BLM to use aminopyralid, fluroxypyr, and rimsulfuron in addition to the currently approved herbicides; 2) an alternative that would prohibit aerial spraying of the three new herbicides; and 3) an alternative that would only allow the BLM to add the two new herbicides without acetolactate synthase-inhibiting active ingredients (aminopyralid and fluroxypyr). Under all alternatives (including the No Action Alternative), projected maximum total use of herbicides would be the same, at 932,000 acres annually.

RESPONSIBLE OFFICIAL FOR PEIS:

Edwin Roberson
Assistant Director
Bureau of Land Management

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

Proposed Action and Purpose and Need

The Bureau of Land Management (BLM), an agency of the U.S. Department of the Interior (USDOI), administers vegetation on approximately 247 million acres (public lands) in 17 states in the western U.S., including Alaska. Management of vegetation on public lands is an important function of this agency, including habitat enhancement and management to reduce the risk of wildfires to people and their property. One of the BLM's highest priorities is to promote ecosystem health, and one of the greatest obstacles to achieving this goal is the rapid expansion of invasive plants across public lands. If not eradicated or managed, invasive plants can jeopardize the health of public lands and the activities that occur on them. Herbicides are one method employed by the BLM to manage these plants.

The BLM is proposing to add the herbicides aminopyralid, fluroxypyr, and rimsulfuron to its list of approved active ingredients for use on public lands. These herbicides have been selected based on their effectiveness at controlling invasive plant species and their suitability for the BLM's treatment needs. The new herbicides would be integrated into the herbicide treatment activities that were assessed in the *Vegetation Treatments Using Herbicides on Bureau of Land Management Land in 17 Western States Programmatic Environmental Impact Statement* (2007 PEIS). The Record of Decision (ROD) for the 2007 PEIS allows the BLM to use 18 herbicide active ingredients for a full range of vegetation treatments in 17 western states. Therefore, the proposed action would increase the number of herbicide active ingredients available to the BLM from 18 to 21.

Proposed treatments using aminopyralid, fluroxypyr, and rimsulfuron would occur on public lands in the western U.S., subject to the restrictions on the individual label of the associated formulation of each active ingredient. Components of site-specific treatment programs, including herbicide application methods utilized, acres treated, and treatment locations, would be determined at the local level and by Congressional direction and funding. While the ROD for the 2007 PEIS makes no decisions regarding the number of acres that can be treated using herbicides, the maximum treatment acreage assumed in the 2007 PEIS—932,000 acres annually—is being carried over to this action.

The need for the proposed action is the ongoing spread of noxious weeds and other invasive plants, which degrade the health of public lands and affect resources such as wildlife, native plant communities, threatened and endangered species, soil, water, and recreation Some invasive vegetation acts as a hazardous fine fuel and contributes to the frequency, extent, and severity of wildfires. The BLM requires effective tools for control of invasive plants in order to prevent their spread into non-infested areas, restore desirable vegetation in degraded areas, and reduce wildfire risk. In particular, the BLM has identified the need for additional herbicide active ingredients that: 1) have less environmental and human health impacts than some of the currently approved herbicides (e.g., picloram); 2) increase options for management of invasive annual grasses; and 3) address potential herbicide resistance by certain species (e.g., kochia, marestail, and pigweed) to active ingredients currently used by the BLM.

The purpose of the proposed action is to improve the effectiveness of the BLM's vegetation management program by allowing herbicide treatments with aminopyralid, fluroxypyr, and rimsulfuron. This action, by increasing the number of active ingredients, would give the BLM increased flexibility and options when designing on-the-ground herbicide treatments.

Herbicide Active Ingredients Evaluated

The three new herbicides that the BLM proposes to use are registered and available for use by the general public. Aminopyralid, fluroxypyr, and rimsulfuron have been deemed effective in managing target vegetation, have minimal effects on the environment and human health if used properly, and are registered with the U.S. Environmental Protection Agency (USEPA).

All three of the new active ingredients would be used to help reduce the spread of noxious weeds and other invasive plants to reduce the buildup of hazardous fuels and risk of wildfire; reduce the loss of wildlife habitat; help stabilize and rehabilitate sites impacted by fire; and restore native plant communities.

Aminopyralid

Aminopyralid, primarily used for the management of broadleaf weeds, is a selective herbicide that is used to manage invasive annual, biennial, and perennial herbaceous species, along with woody species. Target plants include, but are not limited to: Russian knapweed, musk thistle, spotted knapweed, yellow starthistle, Russian thistle, and tansy ragwort. These noxious weeds displace native plant species. Aminopyralid is registered under the USEPA's reduced risk initiative. It may be used instead of picloram in certain situations. Although not currently registered for aquatic use, it is likely that aminopyralid will receive an aquatic registration in the near future that would allow for incidental overspray of this herbicide during treatment of vegetation within close proximity to wetland and riparian areas.

Fluroxypyr

Fluroxypyr is a selective herbicide that is used to manage certain annual and perennial weeds, including broadleaf species that are resistant to sulfonylurea herbicides, such as annual kochia. It can be used to manage invasive plants while maintaining native rangeland grass species, and can be tank-mixed with other active ingredients to improve its ability to manage difficult-to-control weeds such as invasive pricklypear cactus. Other weeds targeted by fluroxypyr include marestail and black henbane. The use of fluroxypyr can reduce the amount of other herbicide products used in treatments.

Rimsulfuron

Rimsulfuron is a selective, acetolactate synthase-inhibiting active ingredient that targets, among other species, annual grasses such as cheatgrass (downy brome) and medusahead rye. Rimsulfuron has been observed to be more effective than imazapic in certain areas and under certain conditions.

Alternative Proposals

Four program alternatives were developed for and evaluated in this PEIS, including the Preferred Alternative and the No Action Alternative. These alternatives were developed based on the alternatives presented in the 2007 PEIS. These alternatives address many of the concerns that were raised during scoping for the 2007 PEIS, as well as concerns raised during scoping for this PEIS. Alternatives were also developed to ensure that the BLM complied with federal, tribal, state, and local regulations. Under all alternatives, the goals of herbicide treatments would continue to be to reduce the risk of wildfire and to improve ecosystem health.

Alternative A – Continue Present Herbicide Use (No Action Alternative)

Under this alternative, the BLM would continue to treat up to 932,000 acres using herbicides annually. Only the 18 active ingredients approved in the ROD for the 2007 PEIS would be available for use by the BLM in its vegetation treatment programs. The most widely used herbicides would be clopyralid, glyphosate, imazapic, tebuthiuron, and triclopyr.

Alternative B - Allow for Use of Three New Herbicides in 17 Western States (Preferred Alternative)

This alternative would allow the BLM to expand its vegetation management program by permitting the use of aminopyralid, fluroxypyr, and rimsulfuron, in addition to the 18 currently approved active ingredients. Therefore, a total of 21 active ingredients would be available for use. Herbicide treatments would continue to occur on up to 932,000 acres annually. It is estimated that aminopyralid would make up 10 percent, fluroxypyr would make up 1 percent, and rimsulfuron would make up 16 percent of the total herbicide use on BLM-administered lands. Use of other herbicides is expected to decrease, particularly glyphosate, imazapic, and picloram.

Alternative C - No Aerial Application of New Herbicides

Alternative C would allow the BLM to expand its vegetation management programs to include the use of aminopyralid, fluroxypyr, and rimuslfuron; however, the three new herbicides could only be applied using ground-based methods. Aerial application (by helicopter or fixed-wing aircraft) would not be allowed. With the addition of three new active ingredients, a total of 21 active ingredients would be available for use. Herbicide treatments would continue to occur on up to 932,000 acres annually. It is estimated that under Alternative C aminopyralid would make up 6 percent, fluroxypyr would make up less than 1 percent, and rimsulfuron would make up 3 percent of the total projected herbicide use on BLM-administered lands. Use of other

herbicides would decrease—particularly glyphosate and imazapic—although not as much as under Alternative B.

Alternative D – No Use of New Acetolactate Synthase-Inhibiting Active Ingredients (No Rimsulfuron)

This alternative would allow the BLM to expand its vegetation management program to include only the two new herbicide active ingredients that do not belong to the sulfonylurea, or the acetolactate synthase-inhibiting, group of herbicide active ingredients. Aminopyralid and fluroxypyr would be approved for use, but rimsulfuron would not. With the addition of two new active ingredients, a total of 20 active ingredients would be available for use. Herbicide treatments would continue to occur on up to 932,000 acres annually. It is estimated that under Alternative C, aminopyralid would make up 10 percent of the total projected herbicide use on BLM-administered lands, and fluroxypyr would make up 1 percent of the total herbicide use.

Direct and Indirect Impacts

In general, potential direct and indirect adverse impacts and benefits would be similar under all of the alternatives. Treatment goals would be the same, and herbicides would be used on roughly the same land area, under all of the alternatives. The small differences among the alternatives would pertain to the relative use of the various active ingredients and the efficacy of treatments based on which active ingredients would be available for use. As aminopyralid, fluroxypyr, and rimsulfuron are of lower toxicity than some of the herbicides currently used by the BLM, toxicological risks associated with herbicide treatments would be lower under the action alternatives, particularly Alternatives B and C.

Impacts from herbicide treatments on local and regional air quality would be minor for all alternatives. Air quality emissions are largely based on acres treated, which would be the same under all the alternatives (including the No Action Alternative). Emissions of criteria pollutants would occur at levels that correspond to minor, short-term impacts to regional air quality. None of the treatments would result in emissions that exceed Prevention of Significant Deterioration thresholds or National Ambient Air Quality Standards. Greenhouse gas emissions would occur under all alternatives, at a fraction of a percent of the total greenhouse gas emissions for the western U.S.

Under all alternatives, impacts to soil would continue to be low. There is no evidence that the currently approved herbicides or new herbicides proposed for use result in adverse impacts to soil. Treatments would benefit soil by restoring natural fire regimes and slowing the spread of invasive plants, which should reduce soil erosion and improve soil productivity. Some treated lands could show a temporary increase in erosion as the target vegetation is killed, followed by an overall reduction in erosion as native vegetation that has more extensive root systems or year-round cover becomes established. Under all alternatives, herbicide use would continue to improve watershed function and water quality by reducing the risk of fire and post-fire sedimentation, and potentially contributing to stabilization of soils and a return to normal fire cycles.

Like the currently approved herbicides, the new herbicides pose risks to vegetation. All three of the new herbicides could adversely impact non-target vegetation. Accidental spills and herbicide drift from treatment areas could be particularly damaging to non-target vegetation, and treatment design would need to consider special status species and populations. Buffer zones would be used to reduce the risks to vegetation from herbicide treatments under all alternatives. Long-term benefits could include a reduction in the spread of invasive plant species and a reduction in the risk of future wildfire in areas where the fire cycle is limiting the ability of native vegetation to establish. Under the action alternatives, the efficacy of some herbicide treatments could be improved through use of the new active ingredients, which may be more effective at managing target species than currently approved herbicides, and may improve control of populations of invasive plant species that have developed a resistance to currently approved herbicides.

Under all of the alternatives, herbicide treatments would continue to pose risks to fish and wildlife. Herbicides have the potential to kill or harm animals, or affect their health and behavior, through exposures such as direct spray, accidental spill, or ingestion of treated food items. Damage to non-target plants from herbicide use could adversely impact habitats used by fish and wildlife. Aminopyralid, fluroxypyr, and rimsulfuron have no to very low risk to fish and wildlife. In some circumstances they would be used instead of currently approved active ingredients with a greater risk. Therefore, overall toxicological risks to fish and wildlife could be lower under the action alternatives

(particularly Alternatives B and C) than under the No Action Alternative.

Under all alternatives, buffers would be used between aquatic habitats and treatments involving terrestrial herbicides to reduce risks to aquatic organisms[1]. Appropriate buffers would also be used between treatment areas and habitats of special status species. Vegetation treatments would adhere to the most recent guidance for special status species, including land use plan decisions for sage-grouse as amended by pertinent sage-grouse EISs, and interim management direction as outlined in Instruction Memorandum 2012-043 (*Greater Sage-Grouse Interim Management Policies and Procedures*). Long-term beneficial effects to fish and wildlife habitat through ecosystem enhancement and reduction in wildfire risk would be similar under all alternatives.

Herbicides would continue to have some risk for toxicological effects to livestock and wild horses and burros that graze in treated rangelands. These animals could be exposed to herbicides by an accidental spill, direct spray, herbicide drift, or by consuming herbicide-treated vegetation. The three new herbicides are of less toxicological risk to animals than some of the herbicides used now, which would likely decrease in usage under the action alternatives. Beneficial effects, which would include improvements to rangeland condition and the quality of forage, would be similar under all alternatives.

Under all alternatives, herbicide treatments could affect cultural or paleontological resources near or on the surface, but would be more likely to affect traditional cultural practices of gathering plants and the health of Native peoples. Cultural and paleontological resources could be impacted by equipment, and to a lesser extent, by the chemicals in herbicides. Based on the results of a human health risk assessment, aminopyralid, fluroxypyr, and rimsulfuron have no to low risks to human health, and have less risk to human health than some of the currently approved herbicides. However, the herbicides that would decrease in usage under the action alternatives also have no to low human health risks. Standard Operating Procedures would help prevent exposures of Native peoples to herbicides. Therefore, risks would be similar under all of the alternatives.

Herbicide treatments could affect visual, wilderness, and recreation resources under all alternatives. The level of these effects would be similar under all the alternatives. Treatments would remove and discolor vegetation, making it less visually appealing. Over the long term, landscapes should be more appealing as native vegetation is restored. Treatments in wilderness and other special areas would detract from the "naturalness" of the area. Although use of mechanical equipment would be strongly discouraged in these areas, even limited use would create noise and reduce the wilderness experience, and would need to be authorized based on further site-specific analysis. Recreationists could be exposed to herbicides or experience less visually-appealing landscapes. In addition, recreational areas could be closed for short periods of time after application to protect the health of visitors. Over the long term, herbicide treatments would be expected to benefit visual resources, wilderness, and recreation by helping to restore native plant communities and reducing the risk of wildfire. The degree of benefits from treatments would be similar under all the alternatives.

Under all alternatives, social effects would be minor at the scale addressed in this PEIS. Herbicide treatment programs would continue to benefit communities that supply workers, materials, or services in support of treatment activities. Some businesses, such as recreation-based businesses and ranching operations, could be adversely affected if treatments closed areas used for recreation or by domestic livestock for extended periods. There are potential environmental justice concerns because a large number of Native peoples and other minority groups live in the West and work in or visit public lands that may be treated with herbicides. The alternatives vary slightly in terms of how much the BLM would spend per herbicide treatment acre. These costs would be only slightly lower under the action alternatives than under the No Action Alternative, and would be lowest under Alternative B.

Based on human health risk assessments, there would be risks to humans (workers and the public) from exposure to herbicides. These risks would be similar under all the alternatives. The three new herbicides have no to very low risk to human health (with an unacceptable risk only predicted for one accidental exposure scenario involving rimsulfuron). All alternatives would be associated with a similar degree

[1] It is likely that aminopyralid will receive an aquatic registration in the near future. If so, buffers associated with its use near aquatic habitats could be reduced.

of benefit to human health associated with management of invasive plants and reduction in wildfire risk.

Cumulative Impacts

The cumulative effects analysis for the 2007 PEIS was for the BLM's larger herbicide treatment program, and is applicable to future treatments with the new active ingredients. Addition of the new herbicides would result in an increase in the number of active ingredients being used on BLM lands.

Herbicide treatments contribute only minor amounts of pollutants to the air, and would reduce the abundance of fire-prone fuels and therefore emissions associated with wildfire, resulting in fewer pollutants accumulating than would occur without treatments. Treatments would contribute to short-term loss of soil functions, process, and productivity, which would be offset by watershed-level restoration treatments. Water quality and hydrology in the western U.S. have been impacted by various human activities, and pollutants have been documented in surface water and groundwater resources. Use of new herbicides would increase the number of potential pollutants used by the BLM, although use of herbicides with a greater risk to water resources would likely decrease as a result of availability of the new active ingredients. Treatments that reduce risk of wildfire and that aim to improve riparian habitats would benefit water resources on and near public lands. Treatments would improve wetland and riparian area functions and values and would slow erosion, which contributes to wetland degradation on public lands. With improvement in these areas, habitat for fish and other aquatic organisms would also improve.

Increased fire frequency and the spread of invasive plants have altered plant communities and fire regime condition class on public land and have led to a cumulative loss of productivity. Herbicide treatments would control invasive plants, and repeated treatments followed by restoration would improve the condition of plant communities and ecosystem processes. Improvement in vegetation characteristics would benefit wildlife. Some species that have adapted to degraded ecosystems could lose habitat as a result of restoring native plant communities, but most species would benefit. Factors that have led to the loss of native vegetation and ecosystem health have adversely impacted rangelands used by domestic livestock and wild horses and burros. Treatments would improve rangelands for these animals, and increase the capacity for public lands to support viable populations of livestock and wild horses and burros.

Treatments could add to the cumulative loss of paleontological and cultural resources, but risks would be low. Treatments could impact plants used by Native peoples for traditional lifeway uses, and the health of Native peoples. However, the BLM would conduct pre-treatment surveys to identify areas of cultural concern before conducting treatments to reduce the cumulative loss of these values.

Treatments would result in some short-term and temporary loss of visual, recreational, and wilderness and other special area values due to vegetation being killed or discolored. In some cases, areas might be closed to visitors during and after treatments; however, these impacts would be short-term and any values affected would be restored within two growing seasons in most cases.

Treatments would benefit local communities by providing jobs and income, and by reducing the risk of wildfire that could harm people and destroy property. These gains would be minor in the context of the western economy, but would still be a cumulative benefit for many rural communities.

Treatments could harm the health of workers and the public. Most herbicides, however, would pose few risks to workers, and even fewer risks to the public, when applied at the typical application rate and in accordance with the label directions. New herbicides proposed for use pose no to very low risk to humans. If treatments restored natural fire regimes, reduced the risk of fire, and slowed the spread of invasive plants, human health would benefit.

Treatments could result in short-term loss of some resources, including, but not limited to, soil, vegetation, wildlife, and livestock forage opportunities. Over the long term, loss of resource values would be slowed, and in some cases, would be reversed. Short-term losses in resource functions would be compensated for by long-term gains in ecosystem health.

TABLE OF CONTENTS AND LISTS OF TABLES, FIGURES, AND MAPS

TABLE OF CONTENTS

Page

Chapter 1. Proposed Action and Purpose and Need 1-1
Introduction 1-1
Proposed Action 1-1
Purpose and Need for the Proposed Action 1-2
Scope of Analysis and Decisions to be Made 1-2
Study Area and Scope of Analysis 1-2
Decisions to be Made 1-3
Documents that Influence the Scope of the PEIS 1-3
Relationship to Statutes, Regulations, and Policies 1-3
NEPA Requirements of the Program 1-4
Interrelationships and Coordination with Agencies 1-4
National Level Coordination 1-4
State and County Level Coordination 1-4
Non-governmental Organizations 1-5
Cooperative Weed Management Areas 1-5
Consultation 1-5
Public Involvement and Analysis of Issues 1-6
Public Scoping Meetings 1-6
Scoping Issues and Concerns 1-6
Development of the Alternatives 1-7
Issues Not Addressed in the Draft PEIS 1-7
Limitations of this PEIS 1-7
Preview of the Remainder of the PEIS 1-7

Chapter 2. Alternatives 2-1
Introduction 2-1
Herbicide Active Ingredients Evaluated under the Proposed Alternatives 2-1
Aminopyralid 2-1
Fluroxypyr 2-2
Rimsulfuron 2-2
Herbicide Formulations Used by the BLM and Tank Mixes 2-2
Description of the Alternatives 2-2
Alternative A – Continue Present Herbicide Use (No Action Alternative) 2-3
Alternative B –Allow for Use of Three New Herbicides in 17 Western States (Preferred Alternative) 2-4
Alternative C – No Aerial Application of New Herbicides 2-4
Alternative D – No Use of New Acetolactate Synthase-Inhibiting Active Ingredients (No Rimsulfuron) 2-7
Alternatives Considered but Not Analyzed Further 2-7
Herbicide Treatment Standard Operating Procedures and Guidelines 2-7
Monitoring 2-9
Coordination and Education 2-9
Mitigation 2-9
Summary of Impacts by Alternative 2-10

Chapter 3. Affected Environment 3-1
Introduction and Study Area 3-1
Land Use and Ecoregions 3-1
Land Use 3-1
Ecoregions 3-1

Climate 3-2
Air Quality 3-2
Greenhouse Gas Emissions and Climate Change 3-2
Class I Areas and Visibility Protection 3-5
Herbicide Drift 3-6
Topography, Geology, Minerals, Oil, and Gas 3-6
Soil Resources 3-6
Biological Soil Crusts 3-7
Micro and Macroorganisms 3-7
Soil Erosion 3-7
Soil Disturbance 3-8
Water Resources and Quality 3-8
Water Resources 3-8
Water Quality 3-9
Wetland and Riparian Areas 3-10
Vegetation 3-11
Vegetation Classification System 3-11
Noxious Weeds and other Invasive Vegetation 3-16
Vegetation Condition and Fire Regimes 3-17
Non-timber and Special Forest Products 3-19
Special Status Species 3-19
Fish and Other Aquatic Organisms 3-19
Special Status Species 3-20
Wildlife Resources 3-20
Special Status Species 3-21
Livestock 3-21
Wild Horses and Burros 3-21
Paleontological and Cultural Resources 3-22
Paleontological Resources 3-22
Cultural Resources 3-22
American Indian and Alaska Native Cultural Resources 3-23
European Settlement Resources 3-23
Important Plant Uses and Species Used by American Indians and Alaska Natives 3-25
Visual Resources 3-25
Wilderness and Other Special Areas 3-26
Recreation 3-28
Rights-of-way, Facilities, and Roads 3-28
Rights-of-way 3-28
Facilities and Roads 3-29
Social and Economic Values 3-29
Social/Demographic Environment 3-29
Economic Environment 3-31
Environmental Justice 3-31
Revenues Generated by BLM Lands 3-32
Expenditures by the BLM 3-34
Human Health and Safety 3-37
Background Health Risks 3-37
Risks from Diseases 3-37
Risks from Injuries 3-39
Risks from Cancer 3-41
Risks from Using Herbicides on Public Lands 3-41
Risks from Wildfire Control on Public Lands 3-41

Chapter 4. Environmental Consequences 4-1
Introduction 4-1
How the Effects of the Alternatives Were Estimated 4-1
Assumptions for Analysis 4-2
Incomplete and Unavailable Information 4-3
Subsequent Analysis before Projects 4-3
Program Goals by Ecoregion 4-4
Land Use 4-4
Air Quality and Climate 4-5
Scoping Comments and Other Issues Evaluated in the Assessment 4-5
Emission Sources and Impact Assessment Methodology 4-5
Methodology for Assessing Impacts to Air Quality 4-5
Standard Operating Procedures 4-6
Impacts by Alternative 4-6
Mitigation for Herbicide Treatment Impacts 4-9
Soil Resources 4-9
Introduction 4-9
Scoping Comments and Other Issues Evaluated in the Assessment 4-10
Standard Operating Procedures 4-10
Factors that Influence the Fate, Transport, and Persistence of Herbicides in Soil 4-10
Impacts of Herbicide Treatments 4-11
Impacts by Alternative 4-12
Mitigation for Herbicide Treatment Impacts 4-14
Water Resources and Quality 4-14
Introduction 4-14
Scoping Comments and Other Issues Evaluated in the Assessment 4-14
Standard Operating Procedures 4-14
Summary of Herbicide Impacts 4-15
Impacts by Herbicide 4-17
Impacts by Alternative 4-18
Mitigation for Herbicide Treatment Impacts 4-20
Wetland and Riparian Areas 4-20
Introduction 4-20
Scoping Comments and Other Issues Evaluated in the Assessment 4-20
Factors that Influence the Fate, Transport, and Persistence of Herbicides in Wetland and Riparian Areas 4-20
Methodology for Assessing Impacts to Wetland and Riparian Areas 4-21
Summary of Herbicide Impacts 4-21
Impacts by Alternative 4-23
Mitigation for Herbicide Treatment Impacts 4-24
Vegetation 4-24
Introduction 4-24
Scoping Comments and Other Issues Evaluated in the Assessment 4-25
Standard Operating Procedures 4-25
Impacts Assessment Methodology 4-25
Impacts of Herbicide Treatments 4-26
Impacts by Ecoregion 4-32
Impacts by Alternative 4-35
Mitigation for Herbicide Treatment Impacts 4-37
Special Status Plant Species 4-37
Introduction 4-37
Impacts Assessment Methodology 4-38
Summary of Herbicide Impacts 4-38

Impacts from Use of the Three New Herbicides 4-38
Mitigation for Herbicide Treatment Impacts 4-40
Fish and Other Aquatic Organisms 4-41
Introduction 4-41
Scoping Comments and Other Issues Evaluated in the Assessment 4-41
Standard Operating Procedures 4-41
Impacts Assessment Methodology 4-42
Summary of Herbicide Impacts 4-43
Impacts by Alternative 4-46
Mitigation for Herbicide Treatment Impacts 4-48
Special Status Fish and Other Aquatic Organisms 4-48
Introduction 4-48
Impacts Assessment Methodology 4-48
Summary of Herbicide Effects to Special Status Fish and Aquatic Invertebrates 4-48
Impacts by Alternative 4-49
Mitigation for Herbicide Treatment Impacts 4-51
Wildlife Resources 4-51
Introduction 4-51
Scoping Comments and Other Issues Evaluated in the Assessment 4-51
Standard Operating Procedures 4-52
Impacts Assessment Methodology 4-52
Summary of Herbicide Impacts 4-53
Impacts of Herbicide Treatments on Wildlife and Habitat by Ecoregion 4-56
Impacts by Alternative 4-58
Mitigation for Herbicide Treatment Impacts 4-59
Special Status Wildlife Species 4-59
Introduction 4-59
Impacts Assessment Methodology 4-59
Summary of Herbicide Effects to Special Status Wildlife Species 4-60
Impacts by Alternative 4-60
Mitigation for Herbicide Treatment Impacts 4-62
Livestock 4-62
Introduction 4-62
Scoping Comments and Other Issues Evaluated in the Assessment 4-62
Standard Operating Procedures 4-63
Impacts Assessment Methodology 4-63
Summary of Herbicide Impacts 4-63
Impacts by Alternative 4-65
Mitigation for Herbicide Treatment Impacts 4-66
Wild Horses and Burros 4-66
Introduction 4-66
Scoping Comments and Other Issues Evaluated in the Assessment 4-67
Standard Operating Procedures 4-67
Impacts Assessment Methodology 4-67
Summary of Herbicide Impacts 4-67
Impacts by Alternative 4-68
Mitigation for Herbicide Treatment Impacts 4-69
Paleontological and Cultural Resources 4-69
Scoping Comments and Other Issues Evaluated in the Assessment 4-70
Standard Operating Procedures for Addressing BLM Actions on Paleontological, Cultural, and Subsistence Resources 4-70
Summary of Herbicide Impacts 4-70
Herbicide Impacts on Native American Health 4-71

Impacts by Alternative ... 4-72
Mitigation for Herbicide Treatment Impacts ... 4-73
Visual Resources ... 4-74
Scoping Comments and Other Issues Evaluated in the Assessment ... 4-74
Standard Operating Procedures ... 4-74
BLM Assessment of Visual Resource Values ... 4-74
Summary of Herbicide Impacts ... 4-75
Impacts by Alternative ... 4-75
Mitigation for Herbicide Treatment Impacts ... 4-76
Wilderness and Other Special Areas ... 4-76
Scoping Comments and Other Issues Addressed in the Assessment ... 4-76
Standard Operating Procedures ... 4-76
Summary of Herbicide Impacts ... 4-77
Impacts by Alternative ... 4-77
Mitigation for Herbicide Treatment Impacts ... 4-78
Recreation ... 4-78
Scoping Comments and Other Issues Evaluated in the Assessment ... 4-78
Standard Operating Procedures ... 4-79
Summary of Herbicide Impacts ... 4-79
Impacts by Alternative ... 4-79
Mitigation for Herbicide Treatment Impacts ... 4-80
Social and Economic Values ... 4-80
Introduction ... 4-80
Scoping Comments and Other Issues Evaluated in the Assessment ... 4-81
Standard Operating Procedures ... 4-81
Impact Assessment Assumptions ... 4-82
Summary of Herbicide Impacts ... 4-82
Impacts by Alternative ... 4-83
Mitigation for Herbicide Treatment Impacts ... 4-85
Human Health and Safety ... 4-85
Scoping Comments and Other Issues Evaluated in the Assessment ... 4-85
Standard Operating Procedures ... 4-86
Human Health Risk Assessment Methodology ... 4-86
Uncertainty in the Risk Assessment Process ... 4-87
Human Health Risks Associated with Herbicides ... 4-88
Impacts by Alternative ... 4-100
Mitigation ... 4-102
Cumulative Effects Analysis ... 4-102
Structure of the Cumulative Effects Analysis ... 4-102
Resource Protection Measures and Other Information Considered in the Cumulative Effects Analysis ... 4-103
Analysis of Cumulative Effects by Resources ... 4-103
Unavoidable Adverse Effects ... 4-114
Relationship between the Local Short-term Uses and Maintenance and Enhancement of Long-term Productivity ... 4-116
Irreversible and Irretrievable Commitment of Resources ... 4-119
Energy Requirements and Conservation Potential ... 4-121
Natural or Depletable Resource Requirements and Conservation ... 4-121

Chapter 5. Consultation and Coordination ... 5-1
Preview of this Section ... 5-1
Public Involvement ... 5-1
Federal Register Notices and Newspaper Advertisements ... 5-1

Scoping Meetings 5-1
Frequently Asked Questions 5-1
Agency Coordination and Consultation 5-2
Endangered Species Act Section 7 Consultation 5-2
Risk Assessment Coordination 5-2
Cultural and Historic Resource Consultation 5-2
Government-to-government Consultation 5-2
List of Preparers of the Programmatic EIS and BA 5-3

Chapter 6. References 6-1

Chapter 7. Glossary 7-1

Chapter 8. Index 8-1

List of Appendices

Appendix A Common and Scientific Names of Plants and Animals Given in the Programmatic EIS A-1
Appendix B Tribal and Agency Consultation B-1
Appendix C Alaska National Interest Lands Conservation Act (ANILCA) § 810 Analysis of Subsistence Impacts C-1
Appendix D Description of Vegetation Macrogroups D-1
Appendix E Special Status Species List E-1

List of Tables

1-1 Key Issues (and Number of Comments) Identified During Scoping and Location Where Issues Are Addressed in this PEIS 1-8
2-1 Formulations of the Three Herbicides Proposed for Use on Public Lands 2-3
2-2 Herbicides Approved and Proposed for Use on Public Lands 2-5
2-3 Average Acreage Treated Annually for Each BLM State Jurisdiction During 2006 to 2012 2-7
2-4 Historic Use of Herbicides by the BLM and Projected Future Use of Herbicides by the BLM under Each Alternative (as a percentage of all acres treated using herbicides) 2-8
2-5 Mitigation Measures 2-10
2-6 Summary and Comparison of Effects on Resources by Alternative 2-11
3-1 Acres of Public Lands in 17 Western States and Percent of the State Administered by the BLM 3-1
3-2 National Ambient Air Quality Impact Significance Criteria 3-3
3-3 Counties within the Treatment Area that are Designated Nonattainment or Maintenance Areas for Various Pollutants 3-4
3-4 Vegetation Classification System 3-13
3-5 Estimated Acres of Invasive Plant Infestations on Public Lands in 2014 3-18
3-6 Grazing Permits and Leases in Force and Active Animal Unit Months in 2011 3-22
3-7 Wild Horses and Burros on Public Lands in Fiscal Year 2013 3-23
3-8 Cultural Resources on Public Lands 3-23
3-9 Culture Areas, Prehistoric Occupation Periods, and Selected Common Site Types 3-24
3-10 Visual Resource Management Classes and Objectives and Appropriate Management Activities 3-26
3-11 National Landscape Conservation System and Other Special Designation Areas on Public Lands as of September 2011 3-27
3-12 Estimated Recreation Use of Public Lands During Fiscal Year 2011 3-28
3-13 Population, Age Distribution, and Race in the Western States and Alaska 3-30
3-14 Percent Unemployment for the Western U.S. and Alaska 3-31

3-15 Percent Employment by Industry in 2011 ... 3-32
3-16 Percent of People Below the Poverty Level for the Western U.S. and Alaska ... 3-33
3-17 Revenues Generated from Public Lands by Source for Fiscal Year 2011 ... 3-34
3-18 Estimated Benefits to Local Economies by Recreation on Public Lands in Fiscal Year 2011 ... 3-35
3-19 Summary of BLM Jobs and Expenditures for the Management of the Lands and Resources Program by Activity and Subactivity (dollars in thousands) ... 3-36
3-20 BLM and USDOI Fire Suppression Expenditures Fiscal Year 2007 through Fiscal Year 2013 ... 3-36
3-21 USDOI Unwanted Wildland Fires During 2006 to 2012 ... 3-36
3-22 Herbicide Uses and Costs for Vegetation Treatments on Public Lands During 2011 ... 3-38
3-23 BLM Payments to States and Local Governments during Fiscal Year 2011 ... 3-39
3-24 Mortality Rates (per 100,000 Population) and Causes of Death by State 2010 ... 3-40
4-1 Annual Emissions Summary for Herbicide Treatments under All Alternatives ... 4-6
4-2 Example NAAQS Compliance Analysis for Herbicide Treatments under All Alternatives ... 4-8
4-3 Estimated Soil Half-life (Aerobic Conditions) and Adsorption Affinity for Active Ingredients ... 4-10
4-4 Factors Associated with Herbicide Movement to Groundwater ... 4-16
4-5 Herbicide Physical Properties and Off-site Movement Potential ... 4-16
4-6 Anaerobic Half-life in Soil for Herbicides Analyzed in this PEIS ... 4-21
4-7 Risk Categories Used to Describe Typical Herbicide Effects to Vegetation According to Exposure Scenario and Ecological Receptor Group ... 4-28
4-8 Buffer Distances to Minimize Risk to Non-target Vegetation from Off-site Drift ... 4-29
4-9 Projected Herbicide Treatments, as a Percent of Total Acres Treated, in Each Ecoregion for Each Vegetation Macrogroup under All Alternatives ... 4-33
4-10 Risk Categories Used to Describe Herbicide Effects on Non Special Status Fish and Aquatic Invertebrates According to Exposure Scenario ... 4-45
4-11 Risk Categories Used to Describe Herbicide Effects on Special Status Fish and Aquatic Invertebrates According to Exposure Scenario ... 4-50
4-12 Risk Categories Used to Describe Herbicide Effects on Non Special Status Wildlife According to Exposure Scenario ... 4-54
4-13 Risk Categories Used to Describe Herbicide Effects on Special Status Wildlife According to Exposure Scenario ... 4-61
4-14 Herbicide Risk Categories by Aggregate Risk Index for Occupational Receptors ... 4-89
4-15 Herbicide Risk Categories by Aggregate Risk Index for Public Receptors ... 4-90
4-16 Aminopyralid Aggregate Risk Indices – Occupational Scenarios ... 4-91
4-17 Aminopyralid Aggregate Risk Indices, Routine Exposure Scenarios for Public Receptors, Short-term Exposure ... 4-92
4-18 Aminopyralid Aggregate Risk Indices for Accidental Exposure Scenarios for Public Receptors Based on Maximum Application Rates ... 4-93
4-19 Fluroxypyr Aggregate Risk Indices – Occupational Scenarios ... 4-94
4-20 Fluroxypyr Aggregate Risk Indices, Routine Exposure Scenarios for Public Receptors, Short-term Exposure ... 4-95
4-21 Fluroxypyr Aggregate Risk Indices for Accidental Exposure Scenarios for Public Receptors Based on Maximum Application Rates ... 4-96
4-22 Rimsulfuron Aggregate Risk Indices – Occupational Scenarios ... 4-97
4-23 Rimsulfuron Aggregate Risk Indices, Routine Exposure Scenarios for Public Receptors, Short-term Exposure ... 4-98
4-24 Rimsulfuron Aggregate Risk Indices for Accidental Exposure Scenarios for Public Receptors Based on Maximum Application Rates ... 4-99
5-1 List of Preparers of the Programmatic EIS/BA ... 5-3

List of Figures

2-1 Summary of Acres Treated Using Herbicides During 2006 to 2012 ... 2-3

List of Maps

1-1 Public Lands Administered by the Bureau of Land Management 1-9
3-1 Ecoregion Divisions 3-42
3-2 Class I Areas 3-43
3-3 Oil and Gas Wells on BLM-administered Lands 3-44
3-4 Soil Orders on Public Lands 3-45
3-5 Hydrologic Regions 3-46
3-6 Fire Regime Condition Classes on Public Lands 3-47
3-7 National Landscape Conservation System Areas 3-48

CHAPTER 1

PROPOSED ACTION AND PURPOSE AND NEED

CHAPTER 1

PROPOSED ACTION AND PURPOSE AND NEED

Introduction

The United States Department of the Interior (USDOI) Bureau of Land Management (BLM) administers approximately 247 million acres in 17 western states in the continental United States (U.S.) and Alaska (Map 1-1). One of the BLM's highest priorities is to promote ecosystem health, and one of the greatest obstacles to achieving this goal is the rapid expansion of invasive plants (including noxious weeds and other plants not native to an area) across public lands. These invasive plants can dominate and often cause permanent damage to native plant communities. If not eradicated or controlled, invasive plants jeopardize the health of public lands and the activities that occur on them. Herbicides are one method employed by the BLM to manage these plants.

In 2007, the BLM published the *Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in 17 Western States Programmatic Environmental Impact Statement* (2007 PEIS; USDOI BLM 2007a). The Record of Decision (ROD) for the 2007 PEIS allows the BLM to use 18 herbicide active ingredients available for a full range of vegetation treatments in 17 western states (USDOI BLM 2007b). In the ROD, the BLM also outlines a protocol for identifying, evaluating, and using new herbicide active ingredients. Under the protocol, the BLM is not allowed to use a new herbicide active ingredient until the agency 1) assesses the hazards and risks from using the new active ingredient, and 2) prepares an Environmental Impact Statement (EIS) under the National Environmental Policy Act (NEPA) to assess the impacts to the natural, cultural, and social environment associated with the use of the new active ingredient on BLM-administered lands. While the protocol originally indicated that a Supplemental EIS could be prepared, further legal review determined that since the vegetation treatment program has been implemented, adding new herbicides is considered a new action rather than a supplemental action. Therefore, a separate EIS is required to assess the impacts associated with the use of new herbicides.

Proposed Action

The BLM is proposing to add the herbicides aminopyralid, fluroxypyr, and rimsulfuron to its list of approved active ingredients for use on public lands. These herbicides have been identified by the BLM based on input from BLM field offices and a preliminary assessment of their effectiveness and suitability for the BLM's vegetation treatment needs. The three new herbicides have been registered for use by the U.S. Environmental Protection Agency (USEPA), are deemed effective in controlling vegetation, and have minimal effects on the environment and human health if used according to the herbicide label instructions.

Ecological risk assessments (ERAs) and a human health risk assessment (HHRA) have been completed as part of the PEIS process to be used in support of the assessment of potential impacts of the new herbicide active ingredients.

This action would increase the number of herbicide active ingredients available to the BLM from 18 to 21. The new herbicides would be integrated into the herbicide treatment programs that were assessed in the 2007 PEIS and accompanying Programmatic Environmental Report (17-States PER; USDOI BLM 2007c). Proposed treatments using aminopyralid, fluroxypyr, and rimsulfuron could occur anywhere on the 247 million acres of public lands in the western U.S., including Alaska, unless restricted by the herbicide label or BLM guidelines. Components of site-specific treatment programs, including treatment and herbicide application methods utilized, acres treated, and treatment locations, would be determined at the local level and by Congressional direction and funding.

While the ROD for the 2007 PEIS makes no decisions regarding the number of acres that can be treated using herbicides, the maximum treatment acreage assumed in the 2007 PEIS—932,000 acres annually—is being carried over to this action.

The three new herbicides would be available for use in vegetation treatment programs on public lands immediately after the ROD has been signed.

Purpose and Need for the Proposed Action

The need for the proposed action is the ongoing spread of noxious weeds and other invasive plants, which degrade the health of public lands and affect resources such as wildlife habitat, native plant communities, threatened and endangered species habitat, soil, water, and recreation. Some invasive vegetation acts as a hazardous fine fuel and contributes to the frequency, extent, and severity of wildfires. The BLM requires effective tools for management of invasive plants in order to prevent their spread into non-infested areas, restore desirable vegetation in degraded areas, and reduce wildfire risk. In particular, the BLM has identified the need for additional herbicide active ingredients that: 1) have less environmental and human health impacts than some of the currently approved herbicides (e.g., picloram); 2) increase options for management of invasive annual grasses; and 3) address potential herbicide resistance by certain species (e.g., kochia[1], marestail, and pigweed) to active ingredients currently used by the BLM.

The purpose of the proposed action is to improve the effectiveness of the BLM's vegetation management program by allowing herbicide treatments with aminopyralid, fluroxypyr, and rimsulfuron. This action would increase the number of active ingredients approved for use, and would give the BLM increased flexibility and options when designing on-the-ground herbicide treatments.

Including the three new herbicides in the vegetation management program would also help meet the purposes that were first identified in the 2007 PEIS, which are to provide BLM personnel with the herbicides available for vegetation treatment on public lands and to describe the conditions and limitations that apply to their use.

The overall goals of vegetation treatments with herbicides are to reduce the risk of wildfires by reducing hazardous fuels, stabilize and rehabilitate fire-damaged lands, and improve ecosystem health by 1) controlling invasive plants, and 2) manipulating vegetation to benefit fish and wildlife habitat, improve riparian and wetland areas, and improve water quality in priority watersheds. The ability to utilize aminopyralid, fluroxypyr, and rimsulfuron, in conjunction with other herbicides and vegetation treatments, would help the BLM meet these natural resource goals.

Scope of Analysis and Decisions to Be Made

This PEIS analyzes the effects of using aminopyralid, fluroxypyr, and rimsulfuron to treat vegetation on public lands in the western U.S., including Alaska. These lands include Oregon and California Land Grant lands, Coos Bay Wagon Road lands, National Recreation Areas, Areas of Critical Environmental Concern, and lands administered by the BLM through its National Landscape Conservation System (NLCS), such as Wilderness Study Areas (WSAs), designated Wilderness Areas, National Monuments, and National Conservation Areas.

Study Area and Scope of Analysis

The study area for this PEIS is generally the same as the study area for the 2007 PEIS. It includes all BLM-administered lands in the 17 western states of Alaska, Arizona, California, Colorado, Idaho, Nebraska, Nevada, New Mexico, North Dakota, Montana, Oklahoma, Oregon, South Dakota, Texas, Utah, Washington, and Wyoming. The total acreage of the study area is approximately 247 million acres (USDOI BLM 2013a).

Because this PEIS is programmatic in nature, it makes broad assumptions about the acreages that would be treated annually by the three herbicides proposed for use. More specific estimates of acreages treated would be made at the regional, state, or local level, and assessed in step-down EISs or Environmental Assessments.

This PEIS provides a background source of information to which any necessary subsequent environmental analyses can be tiered. In general, the NEPA process may be done at multiple scales, depending on the scope of the proposal. This PEIS represents the broadest level of analysis; at this level, the study contains a broad environmental impact analysis, focuses on general policies, and provides Bureau-wide decisions on herbicide use. Additionally, it provides an umbrella

[1] Common and scientific names of plants and animals used in this PEIS are provided in Appendix A.

Endangered Species Act (ESA) Section 7 consultation for the range of activities described in the PEIS. The various scales of analysis and the tiering process are discussed in more detail in the 2007 PEIS (USDOI BLM 2007a:1-9 to 1-10).

Decisions to be Made

The BLM will use the information in this PEIS and public comments on the draft and final PEIS to develop a ROD for the proposed action, which will be released at least 30 days after the Notice of Availability of the final PEIS is published. The ROD will indicate which alternative is selected for implementation.

As part of selecting an alternative, the BLM decision-maker may choose to implement a portion of the selected alternative (such as approving only one or two of the three herbicides), or combine features of multiple alternatives (such as restricting aerial application of only one or two of the three herbicides). The ROD will address significant impacts, alternatives, environmental preferences, and relevant economic and technical considerations.

If the decision-maker decides to approve the use of one or more new active ingredients, the ROD will also indicate what standard operating procedures (SOPs) and mitigation will be implemented to minimize the impacts of herbicide treatments with the three new active ingredients, or will identify new SOPs. These SOPs and mitigation measures would be implemented in addition to those already specified in the ROD for the 2007 PEIS.

Documents that Influence the Scope of the PEIS

Much of the scope of this PEIS is based on the PEIS prepared in 2007 to evaluate the use of herbicides for vegetation treatments on public lands. The 2007 PEIS provides a detailed discussion of the BLM's vegetation management programs and herbicide use on BLM lands, and evaluates the risks of using the 18 herbicides currently approved for use by the BLM. Under the current proposal, the herbicides approved for usage by the 2007 PEIS would continue to be used, and overall vegetation management programs would be mostly unchanged, with the exception of the addition of the three new herbicides. Where appropriate, information in the 2007 PEIS that is relevant to analysis of the current proposal is cited and incorporated by reference.

Documents that provide policy and guidance for hazardous fuels reduction and land restoration activities to reduce the risk of wildfires and restore fire-adapted ecosystems include: the *National Fire Plan* (USDOI and USDA 2001); the Healthy Forests Initiative of 2002 and the Healthy Forests Restoration Act of 2003 (Public Law 108-148); Chapter 3 (Interagency Burned Area Emergency Stabilization and Rehabilitation) in BLM Manual 620, *Wildland Fire Management* (USDOI BLM 2004); *A Collaborative Approach for Reducing Wildland Fire Risks to Communities and the Environment 10-Year Strategy Implementation Plan* (USDOI and USDA 2006a); *Interagency Burned Area Rehabilitation Guidebook* (USDA and USDOI 2006b); the *Emergency Stabilization and Rehabilitation Handbook* (H-1742-1; USDOI BLM 2007d); and the *National Strategy* (USDOI and USDA 2014). Additional documents and policies that influence the scope of this PEIS are listed in the 2007 PEIS (USDOI BLM 2007a:1-6 and Appendix F).

Relationship to Statutes, Regulations, and Policies

The 2007 PEIS details the federal laws, regulations, and policies that influence vegetation treatments on BLM-administered lands (USDOI BLM 2007a:1-6 to 1-8). These include the Federal Land Policy Management Act of 1976 (FLPMA), Taylor Grazing Act of 1934, Oregon and California Grant Lands Act of 1937, Carson-Foley Act of 1968, Plant Protection Act of 2000, Section 15 of the Federal Noxious Weed Act of 1974, as amended, Noxious Weed Control Act of 2004, Public Rangelands Improvement Act of 1978, Clean Air Act, Safe Drinking Water Act, Wilderness Act of 1964, Clean Water Act, Federal Insecticide, Fungicide, and Rodenticide Act, Federal Food, Drug, and Cosmetic Act, Food Quality Protection Act of 1996, Resource Conservation and Recovery Act, Comprehensive Environmental Response, Compensation and Liability Act, Migratory Bird Conservation Act of 1929, as amended, ESA of 1973, Wild Free-Roaming Horse and Burro Act of 1971, as amended by the Public Rangelands Improvement Act of 1978, Fish and Wildlife Conservation Act of 1980, Sikes Act of 1974, Historic Sites Act of 1935, National Historic Preservation Act of 1966 (NHPA), Archaeological Resources Protection Act of 1979, American Indian Religious Freedom Act of 1978, Native American Graves Protection and Repatriation Act of 1990, Section 810 of the Alaska National Interest Lands Conservation Act, Executive Order (EO) 11990 (*Protection of*

Wetlands), EO 12898 (*Environmental Justice*), EO 13045 (*Protection of Children from Environmental Health Risks and Safety Risks*), EO 13084 (*Consultation and Coordination with Indian Tribal Governments*), EO 13112 (*Invasive Species*), and EO 13186 (*Responsibilities of Federal Agencies to Protect Migratory Birds*).

Since the 2007 PEIS, the BLM has implemented a new policy requiring consultation with Alaska Native Corporations on the same basis as American Indian and Alaska Native Tribes.

NEPA Requirements of the Program

Federal agencies are required to prepare an EIS when the proposed action is likely to have a significant impact on the quality of the human environment (42 U.S.C. [United States Code] 4321 et seq; USDOI BLM 2008a). An EIS is intended to provide decision-makers and the public with a complete and objective evaluation of significant environmental impacts, beneficial and adverse, resulting from the proposed action and all reasonable alternatives.

The intent of this PEIS is to comply with NEPA by assessing the programmatic level impacts of using aminopyralid, fluroxypyr, and rimsulfuron to treat vegetation on public lands administered by the BLM. Additional guidance for NEPA compliance and for assessing impacts is provided in the Council on Environmental Quality (CEQ) *Regulations for Implementing the Procedural Provisions of NEPA* (40 Code of Federal Regulations [CFR] Parts 1500-1508), and the *BLM National Environmental Policy Act Handbook* H-1790-1 (USDOI BLM 2008a).

Interrelationships and Coordination with Agencies

In its role as manager of approximately 247 million acres in the western U.S., including Alaska, the BLM has developed numerous relationships at the federal, tribal, state, and local levels, as well as with conservation and environmental groups with an interest in resource management, and private landowners. Included are members of the public that use public lands or are affected by activities on public lands.

National Level Coordination

The BLM regularly coordinates with the numerous federal agencies that administer laws that govern activities on public lands, administer lands adjacent to or in close proximity to public lands administered by the BLM, or that have oversight or coordination responsibilities. These agencies include the Department of Defense; Department of Energy; National Park Service; U.S. Fish and Wildlife Service (USFWS); Bureau of Reclamation; Bureau of Indian Affairs; U.S. Department of Agriculture (USDA) Forest Service; Agricultural Research Service; Animal, Plant Health Inspection Service; Natural Resources Conservation Service; and U.S. Geological Survey Biological Services.

National level coordination that is pertinent to the proposed project includes coordination of invasive species management, and fire and fuels management. The National Invasive Species Council, which involves 13 federal departments and agencies, was established by EO 13112 to develop strategies for coordinated, effective, and efficient control of invasive species on federal lands. Participating agencies include (but are not limited to) the U.S. Departments of Agriculture, Interior, Commerce, Defense, Transportation, and Health and Human Services, and the USEPA. Other groups that coordinate invasive species management at the national level include the Federal Interagency Committee for the Management of Noxious and Exotic Weeds, the Federal Interagency Committee on Invasive Terrestrial Animals and Pathogens, and the Aquatic Nuisance Task Force. These groups are discussed further in the 2007 PEIS (USDOI BLM 2007a:1-11).

The Wildland Fire Leadership Council, Interagency Fuels Management Committee, and National Wildfire Coordinating Group are national-level interagency groups that coordinate wildland fire and fuel management issues. The *National Cohesive Wildfire Management Strategy* provides a long-term, national-level strategy for reducing the effects of wildfires throughout the U.S.

State and County Level Coordination

The BLM is required to coordinate with state and local agencies under several acts, including: the Clean Air Act, the Sikes Act, FLPMA, and Section 106 of the NHPA.

The BLM coordinates closely with state resource management agencies on issues involving the management of public lands, the protection of fish and wildlife populations, including federal- and state-listed threatened and endangered species, invasive and noxious weeds, fuels and wildland fire management, and herbicide application. Herbicide applications are also coordinated with state and local water quality agencies to ensure treatment applications are in compliance with applicable water quality standards. At the agency or state level, vulnerability assessments are done for treatment programs to ensure that they do not result in unacceptable surface water or groundwater contamination. Thus, coordination of this issue must include a groundwater specialist either at the agency level or state level to make the vulnerability assessment.

Local and state agencies work closely with the BLM to manage weeds on local, state, and federal lands, and are often responsible for vegetation treatments on public lands. The BLM participates in exotic plant pest councils, state vegetation and noxious weed management committees, state invasive species councils, county weed districts, and weed management associations found throughout the western U.S.

Non-governmental Organizations

The BLM coordinates at the national and local levels with several resource advisory groups and non-governmental organizations, including: BLM Resource Advisory Councils, the Western Governors' Association, the National Association of Counties, the Western Area Power Administration, the National Cattlemen's Beef Association, the American Sheep Industry, the Society of American Foresters, and the American Forest and Paper Association. The BLM also solicits input from national and local conservation and environmental groups with an interest in land management activities on public lands, such as The Nature Conservancy. These groups provide information on strategies for weed prevention, effective treatment methods, use of domestic animals to manage invasive plants, landscape level planning, vegetation monitoring, and techniques to restore land health.

Cooperative Weed Management Areas

Cooperative Weed Management Areas (CWMAs) are composed of local, private, and federal interests. CWMAs typically center on a particular watershed or similar geographic area in order to pool resources and management strategies in the prevention and control of invasive plant populations. Much of the BLM's on-the-ground invasive species prevention and management is done directly or indirectly through CWMAs. The BLM participates in numerous CWMAs throughout the west, several of which are showcase examples of interagency and private cooperation in restoring land health.

Consultation

As part of this PEIS the BLM consulted with the USFWS and the National Marine Fisheries Service (NMFS), as required under Section 7 of the ESA. The BLM prepared a formal initiation package that included: 1) a description of the program, listed threatened and endangered species, species proposed for listing, and critical habitats that may be affected by the program; and 2) a *Biological Assessment for Vegetation Treatments with Aminopyralid, Fluroxypyr, and Rimsulfuron on Bureau of Land Management Lands in 17 Western States* (USDOI BLM 2015). The BA evaluated the likely impacts to listed species, species proposed for listing, and critical habitats from the proposed use of aminopyralid, fluroxypyr, and rimsulfuron in the BLM's vegetation treatment programs, and identified conservation measures to minimize impacts to these species and habitats. Consultation with USFWS addresses populations of sage-grouse that are proposed for listing, but not populations that are currently candidates for listing. However, all BLM actions must comply with land use plan decisions, as amended by pertinent sage-grouse EISs. Interim management direction is outlined in Instruction Memorandum 2012-043, *Greater Sage-Grouse Interim Management Policies and Procedures*.

The BLM initiated consultation with Native American tribes, Alaska Native groups, and Alaska Native Corporations to identify their cultural values, religious beliefs, traditional practices, and legal rights that could be affected by BLM actions. Consultation included sending out letters to all tribes and groups that could be directly affected by vegetation treatment activities, and requesting information on how treatments with the three new herbicides could impact Native American and Alaska Native interests, including the use of vegetation and wildlife for subsistence, religious, and ceremonial purposes (see Appendix B). Formal consultations with Indian tribes and Alaska Native Corporations may also be required during implementation of projects at the local level.

The BLM conducted an Alaska National Interest Lands Conservation Act (ANILCA) 810 Analysis of

Subsistence. During this process, the BLM invited public participation and collaborated with Alaska Natives to identify and protect culturally significant plants used for food, baskets, fiber, medicine, and ceremonial purposes. The findings are presented in Appendix C.

The BLM consulted with State Historic Preservation Offices (SHPOs) as part of Section 106 consultation to determine how proposed vegetation treatment actions could impact cultural resources. Formal consultations with SHPOs also may be required during implementation of projects at the local level.

Public Involvement and Analysis of Issues

Scoping is the process by which the BLM solicits internal and external input on the issues, impacts, and potential alternatives that will be addressed in an EIS, as well as the extent to which those issues and impacts will be analyzed in the document (USDOI BLM 2008a). Scoping also helps to begin identifying incomplete or unavailable information and evaluating whether that information is essential to a reasoned choice among alternatives.

The BLM published a Federal Register (FR) Notice of Intent (NOI) on December 21, 2012, notifying the public of its intent to prepare a PEIS to evaluate the use of aminopyralid, fluroxypyr, and rimsulfuron herbicides as part of its vegetation treatment programs in 17 western states. The NOI also identified the locations and times of three scheduled public scoping meetings, and stated that comments on the proposal would be accepted until February 19, 2013.

Public notices of the scoping period and public meetings were placed in newspapers serving areas in or near locations where the meetings were held.

Public Scoping Meetings

Three public scoping meetings were held: one in Worland, Wyoming (on January 7, 2012), one in Reno, Nevada (January 9), and one in Albuquerque, New Mexico (January 10). Decisions on where to hold meetings were based on levels of attendance at scoping meetings in these locations for the 2007 PEIS, as well as discussions with local BLM offices. The determination not to hold one or more scoping meetings in Alaska was made by the BLM District office in Fairbanks, based on low attendance at the meetings for the 2007 PEIS, low past and projected future use of herbicides in Alaska, and the overlap of the public scoping period with that of another Environmental Assessment involving herbicide use. In lieu of a public scoping meeting, the Alaska state office offered to host a web-based meeting for anyone who wanted to learn more about the project and provide comments. As no members of the public responded to this offer, no web-based meeting for the project was held.

The scoping meetings were conducted in an open-house style. Information displays were provided at the meeting, and handouts describing the project, the NEPA process, issues, and alternatives were given to the public. A formal presentation provided the public with additional information on program goals and objectives. At each meeting, the presentation was followed by a question and answer session.

The BLM received 26 requests to be placed on the mailing list from individuals, organizations, and government agencies, and 43 written comment letters, emails, or facsimiles on the proposal. In addition to written comments received at the scoping meetings, four individuals provided oral comments. As most of the comment letters provided multiple comments, a total of 255 individual comments were catalogued and recorded during the public scoping period. A *Scoping Summary Report for the Vegetation Treatments Using Aminopyralid, Fluroxypyr, and Rimsulfuron on Bureau of Land Management Lands in 17 Western States Programmatic Environmental Impact Statement* (AECOM 2013) was prepared that summarized the issues and alternatives identified during scoping.

Scoping Issues and Concerns

The vast majority of scoping comments received were supportive of the BLM's proposal to add aminopyralid, fluroxypyr, and rimsulfuron to its list of active ingredients. Respondents provided information on the effectiveness and safety of the three herbicides, as well as extensive comments about the need to utilize these herbicides to effectively control weeds.

The primary issues of concern identified during scoping include the following:

- Need to develop a better mechanism for notifying the public of aerial spraying of herbicides, and implement additional preventative measures for future applications to minimize impacts to human health. Establish larger buffers between herbicide application

areas and human habitation and/or sensitive, high value crops.

- Need to discuss the screening process that the BLM uses to determine whether chemical applications are necessary when other types of treatments are considered.
- Concerns about long-term persistence of aminopyralid and fluroxypyr in treated plant materials, and the potential to transport plant tissue or manure of livestock that have ingested this material to sensitive areas, croplands, and broadleaf garden plants.
- Concerns about impacts to water quality and aquatic resources, including detection of aminopyralid in groundwater and associated impacts to irrigated plants/crops.
- Concerns about the risks to human health and safety from herbicide use.
- Concerns about disproportionate adverse effects to minority and low-income populations.
- Need to evaluate options for restoration activities following invasive plant removal to prevent reestablishment of target species.
- Need to consider climate change, both in terms of its effect on herbicide efficacy and greenhouse gas emissions associated with the proposed project.
- Recommendation that vegetation treatments with the proposed herbicides be monitored to determine their effectiveness.

A summary of issues raised by scoping comments is provided in Table 1-1.

Development of the Alternatives

Public comments were considered when developing alternatives for analysis in this PEIS. As there were several comments about herbicide drift during aerial spraying and other human health effects, alternatives addressing these issues are evaluated in the PEIS. The alternatives also reflect the alternatives that were developed for the 2007 PEIS, as applicable. They reflect public comments received during scoping for the 2007 PEIS that suggested the BLM avoid aerial applications of herbicides or avoid the use of acetolactate synthase (ALS)-inhibiting active ingredients.

Issues Not Addressed in the Draft PEIS

A very small number of comments were not addressed in the PEIS because they were beyond the scope of the document or did not meet the basic purpose and need of the project. These comments primarily pertained to streamlining or changing the evaluation process for new herbicides, which is outside the scope of this PEIS. Additionally, one comment requested an analysis of whether increased carbon dioxide (CO_2) in the atmosphere could affect efficiency of herbicides, which is also outside the scope of this PEIS.

Limitations of this PEIS

This PEIS is a programmatic document that addresses the broad impacts associated with the proposed action and alternatives to the proposed action. Environmental impacts are assessed at a general level because of the broad land area analyzed in the PEIS. Site-specific impacts would be assessed in NEPA documents prepared by local BLM offices and tiered to this document.

The analyses of impacts of the use of herbicides in this PEIS are based on the best and most recent information available. As is always the case when developing management direction for a wide range of resources, not all information that might be desired was available. In these cases, discussions follow the direction provided in the CEQ Regulations for incomplete or unavailable information (40 CFR 1502.22[b]). In cases where impacts could not be quantified, they have been described in qualitative terms.

Preview of the Remainder of the PEIS

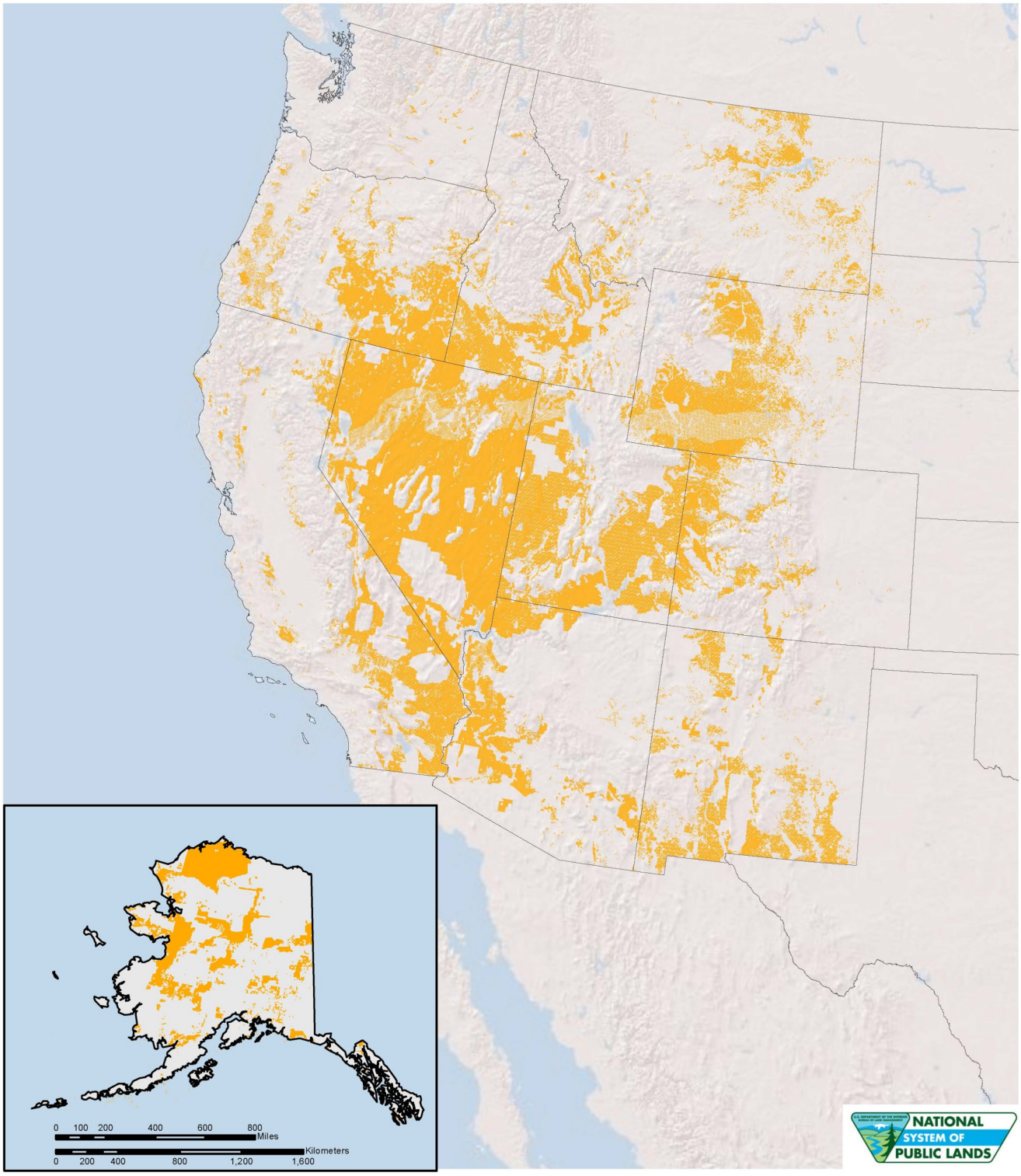
The format of this PEIS follows guidance provided by the CEQ and *BLM National Environmental Policy Act Handbook H-1790-1* (USDOI BLM 2008a).

- Chapter 2, Alternatives, describes and compares the proposed alternatives.
- Chapter 3, Affected Environment, presents existing natural and socioeconomic resources on public lands in the western U.S.

- Chapter 4, Environmental Consequences, evaluates the impacts of the alternatives on public land resources in the western U.S., and describes mitigation proposed for program-related impacts to resources.
- Chapter 5, Consultation and Coordination, describes the scoping and public hearing processes, agencies contacted, and government-to-government consultation, and lists the preparers of this PEIS.
- Chapter 6, References, lists the documents and other sources used to prepare this PEIS.
- Chapter 7, Glossary, Provides definitions for important terms used in this PEIS.
- Chapter 8, Index, lists where significant issues, resource descriptions, NEPA terms, and agencies and groups discussed in this PEIS are located.
- Appendices A through E provide supplemental information that is pertinent to the analysis presented in this PEIS.
- Acronyms, Abbreviations, and Symbols (a fold out at the end of the document) lists the acronyms, abbreviations, and symbols used in this PEIS.

TABLE 1-1
Key Issues (and Number of Comments) Identified During Scoping and Location Where Issues Are Addressed in this PEIS

Issue	Where Addressed in PEIS
Interrelationships	
Consider adjacent private, state, and federally owned lands, and coordinate weed control efforts (2)	1-4
Description of Alternatives	
Clarify the number of acres that would be treated (1)	2-3
Clarify that the new herbicides would not replace currently approved herbicides (1)	1-1, 2-2
Incorporate BMPs for aerial applications to adequately notify the public and avoid accidental public exposures to spraying (1)	4-85, 4-86
Do not spray where there is a risk to crops (1)	2-7, 4-81
Herbicide Treatment Standard Operating Procedures and Guidelines	
Discuss the screening process used to decide whether chemical applications are necessary (1)	2-7
Evaluate options for restoration of treated areas following invasive plant removal (1)	2-7
Incorporate effective monitoring of treated areas (1)	2-7
Affected Environment	
Thoroughly discuss cheatgrass, yellow starthistle, and other noxious weeds and non-native species and the degree to which they threaten BLM lands (6)	3-16
Environmental Consequences	
Address the impacts of the three herbicides compared to those of other herbicides and treatment methods (6)	Chapter 4
Address the impacts associated with residual effects of aminopyralid, including its spread to sensitive areas by grazing animals and damage to crops associated with use of contaminated manure and compost materials (3)	4-11, 4-27, 4-82
Include a discussion of climate change and greenhouse gas emissions (1)	4-7, 4-103
Assess the effects of composting operations and how treated plants would be disposed of (1)	4-82
Address the potential for surface water, groundwater, and drinking water contamination by the three herbicides (1)	4-15
Address herbicide drift and potential impacts to nearby private lands (1)	4-82, 4-85
Address human health and safety risks associated with use of the three herbicides (1)	4-85
Include an environmental justice analysis (1)	4-83



Legend

BLM-administered Lands

State Boundaries

N
W E
S

Map 1-1
Public Lands Administered by the Bureau of Land Management

0 50 100 200 300 400
Miles
Kilometers
0 50 100 200 300 400

Source: BLM National Science and Technology Center 2012.
Note: Coverage for BLM-administered lands is not available for Texas, Nebraska, or Oklahoma.

No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completness of these data for individual or aggregate use with other data.
Original data were compiled from various sources. This information may not meet National Map Accuracy Standards.
This product was developed through digital means and may be updated without notice.

CHAPTER 2

ALTERNATIVES

CHAPTER 2

ALTERNATIVES

Introduction

Introductory and background information pertinent to BLM herbicide treatment programs were provided in the 2007 PEIS (USDOI BLM 2007a:2-1 to 2-14). This information is still applicable, and is pertinent to the three herbicides addressed in this PEIS in terms of BLM programs that implement herbicide treatments, planning and management of vegetation treatments, and the integration and selection of treatment methods within treatment projects.

The BLM's overarching goals for vegetation management are to improve biological diversity and ecosystem function, promote and maintain native and resilient plant communities, and reduce invasive vegetation and the risk of wildfire. Public lands are administered under the principles of multiple use and sustained yield. Thus, vegetation must be managed to protect and enhance the health of the land.

Under all three action alternatives, the BLM would be able to use the new herbicides immediately after the signing of a ROD. Site-specific NEPA analyses would be required prior to on-the-ground use of the new herbicides. The new active ingredients would be integrated into the BLM's vegetation treatment activities. They could be used anywhere on BLM lands, subject to any applicable restrictions on their usage, such as those identified on the individual pesticide label and by each state's pesticide regulatory agency.

Herbicide Active Ingredients Evaluated under the Proposed Alternatives

The BLM proposes to add three new herbicide active ingredients—aminopyralid, fluroxypyr, and rimsulfuron—to its approved herbicide list. All three of these herbicides have been registered by the USEPA and deemed effective in controlling vegetation, and have minimal effects on the environment and human health if used in accordance with label instructions.

The new active ingredients were selected based on: 1) input from BLM field offices on types of vegetation needing control; 2) studies indicating that these active ingredients would be more effective in managing noxious weeds and other unwanted vegetation than active ingredients currently used by the BLM; 3) USEPA approval for use on rangelands, forestlands, and/or aquatic environments; 4) input from herbicide manufacturers regarding herbicides not currently approved for use on public lands that may be appropriate to manage vegetation; 5) their effectiveness on a variety of target species on BLM lands; 6) the level of risk of the herbicidal formulations to human health and the environment; and 7) the funds available to the BLM to conduct HHRAs and ERAs of the proposed herbicides.

All three of the new active ingredients would be used to help reduce the spread of noxious weeds and other invasive plants to reduce the buildup of hazardous fuels; reduce the loss of wildlife habitat; help stabilize and rehabilitate sites impacted by fire; and restore native and desirable plant communities.

Aminopyralid

Aminopyralid, primarily used for the management of broadleaf weeds, is a selective herbicide that is used to manage invasive annual, biennial, and perennial herbaceous species, along with woody species. It is applied either aerially or using ground application equipment. It is mobile in both the xylem and phloem of the target plant, and accumulates in leaf and root meristematic tissue. Species targeted by this herbicide include, but are not limited to: Russian knapweed, musk thistle, spotted knapweed, yellow starthistle, Russian thistle, and tansy ragwort (Lee 2013). These species are rangeland weeds that displace native plant species.

Aminopyralid is registered under the USEPA's reduced risk initiative, indicating that the USEPA believes that it poses less risk to human health and the environment than existing herbicide options (USEPA 2012a). Aminopyralid may be used instead of picloram in certain situations. Although not currently registered for aquatic use, it is likely that aminopyralid will receive an aquatic registration in the near future that would allow

for incidental overspray of this herbicide during treatment of vegetation within close proximity to wetland and riparian areas. Aminopyralid is appropriate for use at rangeland, forestland, recreation, and cultural resource sites; along rights-of-way (ROWs); and at energy and mineral sites. It would be used to manage noxious weeds and other invasive plants to restore native plant communities and wildlife habitats, predominantly on rangelands.

Fluroxypyr

Fluroxypyr is a selective, post-emergence herbicide that is used to manage certain annual and perennial weeds, including broadleaf species that are resistant to sulfonylurea herbicides, such as kochia. It can be used to manage invasive plants while maintaining native rangeland grass species. It is applied to actively growing plants using either aerial or ground-based equipment. Fluroxypyr's mode of action is by mimicking auxins and disrupting plant cell growth. It is mobile in the xylem of the plant, and to a lesser extent the phloem. Fluroxypyr can be tank-mixed with other active ingredients to improve its ability to manage difficult-to-control weeds such as invasive pricklypear cactus. Other invasive plant species targeted by fluroxypyr include marestail and black henbane. The BLM has indicated that the use of fluroxypyr can help reduce the amount of other herbicide products used in treatments. It is appropriate for use at rangeland, forestland, recreation, and cultural resource sites; along ROWs; and at energy and mineral sites (Lee 2013). Fluroxypyr would be used to manage noxious weeds and other invasive plants to restore native plant communities and wildlife habitats, predominantly on rangelands. It would also be used to control weeds in disturbed and cleared areas, such as oil and gas sites.

Rimsulfuron

Rimsulfuron is a selective, ALS-inhibiting herbicide that inhibits the biosynthesis of certain amino acids. It is applied both pre- and post-emergence, by ground or aerial methods. Rimsulfuron is active in both the xylem and the phloem of the plant, but primarily the phloem. Species targeted by this herbicide include winter annual grasses, such as cheatgrass (downy brome) and medusahead rye. Rimsulfuron has been observed to be more effective than imazapic in certain areas and under certain conditions. It is appropriate for use at rangeland, forestland, recreation and cultural resource sites; along ROWs; and at energy and mineral sites. Rimsulfuron would be used predominantly on ROWs and rangelands to reduce the buildup of hazardous fuels, and to restore native plant communities.

Herbicide Formulations Used by the BLM and Tank Mixes

The BLM generally uses several formulations of each active ingredient approved for use on public lands. Current USEPA-registered formulations of the three herbicides proposed for use are shown in Table 2-1, which includes the registration number of each formulation, the concentration of the active ingredient, and the herbicide resistance code.

Additionally, the three new herbicides could be used in tank mixes with one or more of the previously approved herbicides. Both aminopyralid and fluroxypyr can be tank mixed with numerous other active ingredients, including 2,4 dichlorophenoxyacetic acid (2,4-D), chlorsulfuron, clopyralid, dicamba + diflufenzopyr, glyphosate, picloram, metsulfuron methyl, sulfometuron methyl, and triclopyr. Fluroxypyr would most commonly be used with clopyralid, picloram, and triclopyr. Rimsulfuron would usually be applied on its own as a pre-emergent herbicide, but could be tank mixed with chlorsulfuron for certain applications, along with other herbicides registered for the same site of application, unless prohibited by the label instructions.

Description of the Alternatives

Four alternatives have been developed for evaluation in this PEIS, including the Preferred Alternative and the No Action Alternative. Alternative actions are those that could be taken to feasibly attain or approximate the BLM's objectives for herbicide use, as expressed in its programs, policies, and land use plans.

Alternatives were developed based on the alternatives in the 2007 PEIS. These alternatives address many of the concerns raised during scoping for the 2007 PEIS, as well as concerns raised during scoping for this PEIS (in particular concerns about aerial spraying).

Under all alternatives, the BLM would continue to follow all of the herbicide treatment SOPs and mitigation measures stipulated in the ROD for the 2007 PEIS. General herbicide treatment SOPs would pertain to treatments with the currently approved active ingredients, as well as any new active ingredients added under the various action alternatives. The BLM would also continue to follow the monitoring requirements in

TABLE 2-1
Formulations of the Three Herbicides Proposed for Use on Public Lands

Active Ingredient	Trade Name	Manufacturer	USEPA Registration Number	Concentration	WSSA Herbicide Resistance Code[1]
Aminopyralid	Milestone	Dow AgroSciences, L.L.C.	62719-519	2.0 lb a.e./gal	Group 4
	Milestone VM	Dow AgroSciences, L.L.C.	62719-537	2.0 1b a.e./gal	Group 4
Aminopyralid + 2,4-D	GrazonNext	Dow AgroSciences, L.L.C.	62719-587	0.33+2.67 lb a.e./gal	Groups 4 + 4
	ForeFront HL	Dow AgroSciences, L.L.C.	62719-630	0.41+3.33 lb a.e./gal	Groups 4 + 4
	ForeFront R&P	Dow AgroSciences, L.L.C.	62719-524	0.33+2.67 lb a.e./gal	Groups 4 + 4
Aminopyralid + Metsulfuron Methyl	Opensight	Dow AgroSciences, L.L.C.	62719-597	0.525+9.45 % a.i.	Groups 4 + 4
Aminopyralid + Triclopyr	Milestone VM Plus	Dow AgroSciences, L.L.C.	62719-572	0.1+1.0 lb a.e./gal	Groups 4 + 4
Rimsulfuron	Matrix	DuPont Crop Protection	352-556	25 % a.i.	Group 2
	Matrix SG	DuPont Crop Protection	352-768	25 % a.i.	Group 2
	Matrix FNV	DuPont Crop Protection	352-671	25 % a.i.	Group 2
Fluroxypyr	Comet	Nufarm, Inc.	71368-87	1.5 lb a.e./gal	Group 4
	Fluroxypyr Herbicide	Alligare, L.L.C.	66330-385-81927	2.8 lb a.e./gal	Group 4
	Vista	Dow AgroSciences, L.L.C.	62719-308	1.5 lb a.e./gal	Group 4
	Vista XRT	Dow AgroSciences, L.L.C.	62719-586	2.8 lb a.e./gal	Group 4
Fluroxypyr + Clopyralid	Truslate	Nufarm, Inc.	71368-86	0.75+0.75 lb a.e./gal	Groups 4 + 4
Fluroxypyr + Picloram	Surmount	Dow AgroSciences, L.L.C.	62719-480	0.67+0.67 lb a.e./gal	Groups 4 + 4
	Trooper Pro	Nufarm, Inc.	228-599	1.0+1.0 lb a.e./gal	Groups 4 + 4
Fluroxypyr + Triclopyr	PastureGard	Dow AgroSciences, L.L.C.	62719-477	0.5+1.5 lb a.e./gal	Groups 4 + 4
	PastureGard HL	Dow AgroSciences, L.L.C.	62719-637	1.0+3.0 lb a.e./gal	Groups 4 + 4

[1] Resistance codes: Group 2 = Inhibition of acetolactate synthase, Group 4 = growth regulators.
lb a.e./gal = pounds of acid equivalent per gallon; % a.i. = percent active ingredient; and WSSA = Weed Science Society of America.

the ROD to ensure that SOPs and mitigation measures are implemented appropriately. New SOPs and mitigation measures may be developed for the action alternatives, and will be discussed, as appropriate, elsewhere in this document. SOPs, mitigation measures, and monitoring requirements that carry over from the 2007 PEIS can be found in Chapter 2 and Appendix B of the ROD, as well as Chapter 2 of the 2007 PEIS (USDOI BLM 2007a:2-22 to 2-56).

Alternative A – Continue Present Herbicide Use (No Action Alternative)

This alternative describes an integrated vegetation management program for resource management and habitat enhancement, with only the herbicides approved in the ROD for the 2007 PEIS used to manage competing and unwanted vegetation. This alternative corresponds to Alternative B of the 2007 PEIS, which estimated that approximately 932,000 acres in the western U.S. would be treated annually using herbicides. As shown in Figure 2-1, total treatment acreages using all herbicides have remained well below this number.

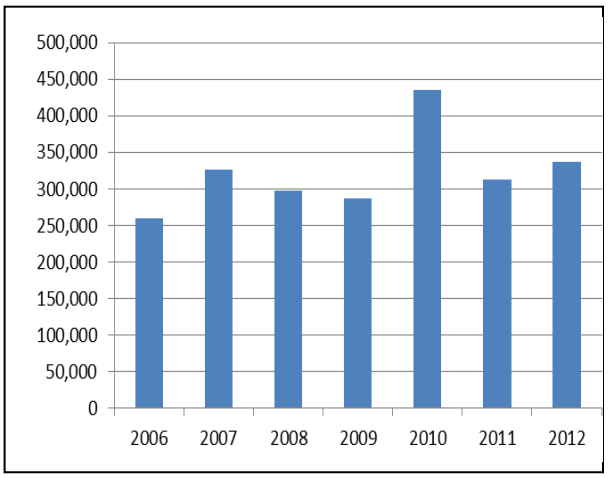


Figure 2-1. Summary of Acres Treated Using Herbicides During 2006 to 2012.

At current funding levels, the BLM has been treating an average of 315,000 acres per year using herbicides. Since 2006, the annual acreage has ranged from about 260,000 to 436,000, with acres treated largely dependent on funding. Increases in funding are typically tied to incidence of wildfire. It is projected that the acreage of public lands treated using herbicides will increase from current levels, but will not exceed the 932,000-acre estimate from the 2007 PEIS. Therefore, the maximum annual treatment area of 932,000 acres is carried over to this PEIS for the purposes of analysis.

Under this alternative, the BLM would continue to use the 18 active ingredients currently approved for use, which are listed in Table 2-2. The majority of treatments would continue to occur in New Mexico, Idaho, and Wyoming, as inferred from Table 2-3. The projected use of each of the 18 approved herbicides under the No Action Alternative is shown in Table 2-4. The most widely used herbicides would be clopyralid, glyphosate, imazapic, tebuthiuron, and triclopyr. Estimates of herbicide use are based on the BLM's assessment of future needs as far as vegetation treatment is concerned. Usage may vary from year to year and percentages may change based on the total acreage treated. Therefore, projected use of a particular herbicide under the No Action Alternative does not necessarily reflect historic usage of that herbicide.

Alternative B – Allow for Use of Three New Herbicides in 17 Western States (Preferred Alternative)

This alternative would allow the BLM to expand its vegetation management program by permitting the use of three new herbicide active ingredients to manage competing and unwanted vegetation. Although the BLM would likely treat more acres with herbicides than it is currently, the projected maximum treatment acres would remain at 932,000 acres annually.

Under the preferred alternative, the BLM would be able to use, in 17 western states, the 18 active ingredients that were approved for use in the 2007 PEIS ROD, as well as aminopyralid, fluroxypyr, and rimsulfuron.

These active ingredients could only be applied for uses, and at application rates, specified on the label and in accordance with the ROD. Under this alternative, herbicides could be applied using ground or aerial methods. Herbicides could be used individually, or tank mixed with previously approved herbicides, as applicable and in accordance with the individual herbicide label.

The projected use of each of the new herbicides, as a percent of use by all approved herbicides, is shown in Table 2-4. It is estimated that aminopyralid would make up 10 percent, fluroxypyr would make up 1 percent, and rimsulfuron would make up 16 percent of the total herbicide use on BLM-administered lands. As a result of adding these new active ingredients, use of other herbicides is expected to decrease, particularly glyphosate, imazapic, and picloram.

Alternative C – No Aerial Application of New Herbicides

This alternative would allow the BLM to use only ground-based techniques to apply the three new herbicides. Projected maximum treatment acres would remain at 932,000 acres annually. This alternative would be similar to Alternative B, except that aerial application (by helicopter or fixed-wing aircraft) of the three new herbicides would not be allowed. The BLM would be restricted to only ground-based methods for applying these herbicides, including by vehicle or on foot with manual application devices. However, aerial application of the 18 previously approved active ingredients, where identified on individual active ingredient labels, and in accordance with BLM policy, would still be able to occur. Herbicides could be used individually, or tank mixed with previously approved herbicides, as applicable. These active ingredients could only be applied for uses, and at application rates, specified on the label, and in accordance with the ROD.

The projected amount of use of the new herbicides under this alternative is shown in Table 2-4. It is estimated that aminopyralid would make up 6 percent, fluroxypyr would make up less than 1 percent, and rimsulfuron would make up 3 percent of the total projected herbicide use on BLM-administered lands. Under this alternative, substantially less rimsulfuron would be used than under Alternative B, as this herbicide would not be applied aerially for large-scale projects to control invasive annual grasses. Aminopyralid use would also be less than under Alternative B. However, all three herbicides would be applied using ground-based methods in various treatment scenarios. As a result of adding the new herbicides, it is predicted that use of other herbicides—particularly glyphosate and imazapic—would decrease compared to the No Action Alternative, although not as much as under Alternative B.

TABLE 2-2
Herbicides Approved and Proposed for Use on Public Lands

Herbicide	Herbicide Characteristics and Target Vegetation	Areas Where Registered Use is Appropriate					
		Rangeland	Forestland	Riparian and Aquatic	Oil, Gas, and Minerals	ROW	Recreation and Cultural Resources
Herbicides Approved for Use on Public Lands							
2, 4-D	Selective; foliar absorbed; postemergent; annual/perennial broadleaf weeds. Key species treated include annual kochia, mustard species, and Russian thistle.	●	●	●	●	●	●
Bromacil	Non-selective; inhibits photosynthesis; controls wide range of weeds and brush. Key species treated include annual grasses and broadleaf weeds, annual kochia, and Russian thistle.				●	●	●
Chlorsulfuron	Selective; inhibits enzyme activity; broadleaf weeds and grasses. Key species treated include biennial thistles and annual and perennial mustards.	●			●	●	●
Clopyralid	Selective; mimics plant hormones; annual and perennial broadleaf weeds. Key species treated include knapweeds, mesquite, and starthistle and other thistles.	●	●		●	●	●
Dicamba	Growth regulator; annual and perennial broadleaf weeds, brush, and trees. Key species treated include knapweeds, annual kochia, and Russian and other thistles.	●			●	●	●
Diflufenzopyr + Dicamba	Postemergent; inhibits auxin transport; broadleaf weeds. Key species treated include knapweeds, annual kochia, and Russian thistle and other thistles.	●			●	●	●
Diquat	Non-selective and foliar applied. Key species treated include giant salvinia, water-thyme, and watermilfoils.			●	◘	◘	◘
Diuron	Preemergent control; annual and perennial broadleaf weeds and grasses. Key species treated include annual grasses and broadleaf weeds, kochia, and Russian thistle.				●	●	●
Fluridone	Aquatic herbicide to control submersed aquatic plants. Key species treated include water-thyme and watermilfoils.			●			
Glyphosate	Non-selective; annual and perennial grasses and broadleaf weeds, sedges, shrubs, and trees. Key species treated include annual, biennial, and perennial grasses and broadleaf weeds and woody shrubs.	●	●	●	●	●	●
Hexazinone	Foliar or soil applied; inhibits photosynthesis; annual /perennial grasses and broadleaf weeds, brush, and trees. Key species treated include mesquite and scrub oak.	●	●		●	●	●
Imazapic	Selective postemergent herbicide; inhibits broadleaf weeds and some grasses. Key species treated include cheatgrass, leafy spurge, medusahead rye, and mustards.	●	●		●	●	●
Imazapyr	Non-selective; preemergent and postemergent uses; absorbed through foliage and roots; annual and perennial broadleaf weeds, brush, and trees. Key species treated include saltcedar.	●	●	●	●	●	●
Metsulfuron methyl	Selective; postemergent; inhibits cell division in roots and shoots; annual and perennial broadleaf weeds, brush, and trees. Key species treated include annual and perennial mustards and biennial thistles.	●	●		●	●	●
Picloram	Selective; foliar and root absorption; mimics plant hormones; certain annual and perennial broadleaf weeds, vines, and shrubs. Key species treated include knapweeds, leafy spurge, and starthistle.	●	●		●	●	●
Sulfometuron methyl	Broad-spectrum preemergent and postemergent control; inhibits cell division; grasses and broadleaf weeds. Key species treated include cheatgrass, annual and perennial mustards, and medusahead rye.		●		●	●	●
Tebuthiuron	Relatively non-selective soil activated herbicide; preemergent and postemergent control of annual and perennial grasses, broadleaf weeds, and shrubs. Key species treated include creosote bush, oak, Russian olive, and sagebrush (thinning).	●			●	●	●

TABLE 2-2 (Cont.)
Herbicides Approved and Proposed for Use on Public Lands

Herbicide	Herbicide Characteristics and Target Vegetation	Areas Where Registered Use is Appropriate					
		Rangeland	Forestland	Riparian and Aquatic	Oil, Gas, and Minerals	ROW	Recreation and Cultural Resources
Triclopyr	Growth regulator; broadleaf weeds and woody plants. Key species treated include mesquite and saltcedar.	●	●	●	●	●	●
Herbicides Proposed for Use on Public Lands							
Aminopyralid	Selective herbicide; plant growth regulator; applied postemergence, either aerially or using ground application equipment; mobile in both the xylem and phloem, accumulating in leaf and root meristematic tissue; limited residual activity; microbial degradation. Targeted species include, but are not limited to: Russian knapweed, musk thistle, spotted knapweed, yellow starthistle, Russian thistle, and tansy ragwort.	●	●		●	●	●
Fluroxypyr	Selective; plant growth regulator; disruption of plant cell growth - auxin mimicking; applied to actively growing plants aerially or using ground application equipment; mobile in the phloem, and to a lesser extent the xylem; microbial degradation; management of several annual and perennial broadleaf species, including ALS-resistant kochia biotypes; provides synergistic activity when tank mixed with certain active ingredients, improving the management of selected species, including pricklypear cactus.	●	●		●	●	●
Rimsulfuron	Selective; ALS-inhibiting herbicide, resulting in the inhibition of the biosynthesis of the branched amino acids isoleucine, leucine, and valine; applied both preemergence and postemergence using ground and aerial application equipment; mobile in both the xylem and phloem, but primarily in the phloem; limited residual; chemical degradation. Target species include cheatgrass and medusahead rye.	●	●		●	●	●

● = Areas where USEPA approved registration exists and the BLM has approval or proposes to use on public lands; ◘ = Areas where USEPA approved registration exists, but where the BLM does not propose to use on public lands.
ROW = rights-of-way
Source: Lee 2013.

Under this alternative, the BLM would develop new SOPs for aminopyralid, fluroxypyr, and rimsulfuron that restrict application by aerial methods.

TABLE 2-3
Average Acreage Treated Annually for Each BLM State Jurisdiction During 2006 to 2012

State	Acres Treated Annually	Percentage of All Public Lands Treated
Alaska	0	0.0
Arizona	5,621	1.8
California	1,525	0.5
Colorado	7,842	2.5
Idaho	35,401	11.2
Montana, North Dakota, and South Dakota	8,857	2.8
Nevada	11,860	3.8
New Mexico, Oklahoma, and Texas	189,654	60.1
Oregon and Washington	12,663	4.0
Utah	8,788	2.8
Wyoming and Nebraska	33,096	10.5
Total	**315,461**	**100.0**

Alternative D – No Use of New Acetolactate Synthase-Inhibiting Active Ingredients (No Rimsulfuron)

This alternative would allow the BLM to utilize the two new herbicide active ingredients that do not belong to the sulfonylurea, or the acetolactate synthase-inhibiting, group of herbicide active ingredients. Aminopyralid and fluroxypyr would be approved for use, but rimsulfuron would not.

Under this alternative the BLM would be able to use a total of 20 herbicide active ingredients (the 18 previously approved active ingredients, plus aminopyralid and fluroxypyr) on public lands in 17 western states. These active ingredients could only be applied on sites, and at application rates, specified on the individual label. Under this alternative, herbicides could be applied using ground or aerial methods. Herbicides could be used individually or in tank mixes with previously approved active ingredients, in accordance with label directions. The projected maximum annual treatment acreage under this alternative would remain at 932,000 acres.

Under this alternative, it is estimated that aminopyralid would make up 10 percent of the total projected herbicide use on BLM-administered lands, and fluroxypyr would make up 1 percent of the total projected herbicide use, similar to Alternative B (Table 2-4). As rimsulfuron would not be approved for use under this alternative, the amount of glyphosate and imazapic used would be greater than under Alternatives B and C, and similar to levels under the No Action Alternative.

Alternatives Considered but Not Analyzed Further

The BLM based the alternatives being considered in this PEIS on the alternatives that were identified for the 2007 PEIS. As herbicide treatments on public lands have already been approved in the 2007 PEIS, Alternative C from that document (No Use of Herbicides) is not applicable and does not meet the current project purpose and need. Based on a review of scoping comments and the current alternatives, no additional alternatives were considered for analysis in this PEIS.

Herbicide Treatment Standard Operating Procedures and Guidelines

Under all of the alternatives, the BLM would follow SOPs designed to minimize risks to human health and the environment from herbicide treatment actions. Standard operating procedures are management controls and performance standards that are required of all herbicide treatments. They are intended to protect and enhance natural resources that could be affected by herbicide treatments. The 2007 PEIS (USDOI BLM 2007a:2-22 to 2-35) provides a detailed discussion of these SOPs, which include the following:

- Prevention measures during project planning, development, and revegetation phases to minimize the risk of introducing or spreading noxious weeds.

- Herbicide treatment planning, which includes evaluation of the need for chemical treatments and their potential for impact on the environment, and development of an operational plan that includes herbicide buffers near water bodies, information on project specifications, key personnel responsibilities and communication, safety, spill, and response, and emergency procedures.

- Procedures specific to site revegetation after treatments to promote establishment and/or recovery by the native plant community.

- Special precautions to minimize impacts to special status species, wilderness areas, and cultural resources.

- Standard operating procedures for applying herbicides (listed in the 2007 PEIS; USDOI BLM 2007a:Table 2-8, 2-30 to 2-35), both general and designed to protect specific resource elements (air quality, soils, water resources, wetlands and riparian areas, vegetation, pollinators, fish and other aquatic organisms, wildlife, listed species, livestock, wild horses and burros, cultural and paleontological resources, visual resources, wilderness and other special areas, recreation, social and economic values, ROWs, and human health and safety).

All applicable SOPs (i.e., pertaining to herbicide treatments) listed in the 2007 PEIS would be followed during treatments with aminopyralid, fluroxypyr, and rimsulfuron under all of the alternatives considered in this PEIS. Additionally, all applicable mitigation measures that were identified in the ROD for the 2007 PEIS (USDOI BLM 2007b:Appendix B) would be followed, as applicable. Many of these mitigation measures are specific to the 18 herbicides covered in the 2007 PEIS, and therefore would not apply to treatments with the three new herbicides unless other herbicides were also involved.

TABLE 2-4
Historic Use of Herbicides by the BLM and Projected Future Use of Herbicides by the BLM under Each Alternative (as a percentage of all acres treated using herbicides)

Active Ingredient	Historic Use (2006-2012)	Projected Use Under Each Alternative			
		No Action Alternative	Preferred Alternative	Alternative C (no aerial)	Alternative D (no ALS inhibiting)
Herbicides Approved for Use on Public Lands					
2,4-D	9.3	6	5	6	5
Bromacil	1.1	<1	<1	<1	<1
Chlorsulfuron	2.0	2	1	2	1
Clopyralid	18.3	13	14	14	14
Dicamba	1.9	1.5	<1	1	<1
Diflufenzopyr + Dicamba	<1	<1	<1	1	<1
Diquat	<1	<1	<1	<1	<1
Diuron	1.9	2	<1	<1	<1
Fluridone	<1	<1	<1	<1	<1
Glyphosate	8.9	12	5	9	11
Hexazinone	<1	<1	<1	<1	<1
Imazapic	1.5	20	10	15	20
Imazapyr	1.7	2	1	1	1
Metsulfuron methyl	2.7	4	1	1	1
Picloram	7.1	8	4	7	4
Sulfometuron methyl	0.2	1	<1	<1	<1
Tebuthiuron	22.5	13	15	15	15
Triclopyr	20.8	15	16	16	16
Herbicides Proposed for Use on Public Lands					
Aminopyralid	0	0	10	6	10
Fluroxypyr	0	0	1	<1	1
Rimsulfuron	0	0	16	3	0

Monitoring

Monitoring of vegetation treatments is used to identify whether treatments are implemented appropriately and determine their effectiveness. The regulations at 43 CFR 1610.4-9 require that land use plans establish intervals and standards for monitoring and evaluating land management actions. Specific monitoring protocols or studies for vegetation treatment projects are developed and implemented at the local level. BLM manuals, handbooks, and other technical documents provide additional information on monitoring of specific resources. A list of applicable reference manuals and handbooks can be found in Appendix F of the 2007 PEIS.

The BLM Assessment, Inventory, and Monitoring (AIM) Strategy outlines the BLM monitoring program, including monitoring for the vegetation resources found on BLM-administered lands and monitoring of the effects of treatments on these vegetation resources. The AIM strategy addresses the BLM's multiple-use and sustainable yield mission, and ensures the collection of defensible data to inform BLM managers and the public about key ecological processes for maintaining sustainable ecosystems. The AIM strategy establishes a monitoring framework that is consistent and compatible across scales, programs, and administrative boundaries. The framework includes 1) use of core quantitative indicators and consistent methods; 2) implementation of a statistically-valid, scalable sampling framework; 3) application and integration of remote sensing technologies; 4) implementation of electronic field data collectors and enterprise data management; and 5) capture of legacy data in a digital format (Toevs et al. 2011). As of November 2014, the AIM Strategy has adopted core indicators and methods for terrestrial and in-stream aquatic resources. Work is ongoing to establish indicators and methods that will inform the status and trends of other resources the BLM manages.

The BLM has adopted an ecosystem-based management approach, which is applied to projects at the site-specific level. The ecosystem-based management framework ensures that local level decisions about management goals and targets are informed and adapted from learning based on science (monitoring) and local knowledge.

The 2007 PEIS (USDOI BLM 2007a:2-35 to 2-39) provides additional discussion of vegetation treatments monitoring, including BLM guidance, procedures for implementation, monitoring methods, and dissemination of results.

Coordination and Education

As indicated during public scoping for this PEIS and the earlier 2007 PEIS, the public has an interest in the BLM's vegetation treatment activities, particularly individuals that live in close proximity to public lands, have commercial operations that are dependent on vegetation on or adjacent to public lands, or use public lands for recreation. The BLM strives to keep the public informed about its vegetation treatment activities through regular coordination and communication. The BLM also encourages the public to participate in the environmental review process during the development and analysis of local vegetation management programs. The 2007 PEIS (USDOI BLM 2007a:2-39) summarizes the ways in which the public can participate in this process, as well as other applicable coordination efforts between the BLM and the public.

Prior to herbicide treatments, the BLM posts entry points onto public lands where the herbicide application will take place. Information provided in the posting includes the name of the herbicide product to be applied, active ingredients, USEPA registration number, application date, the period of time that must elapse before a person without protective clothing may enter a treatment site, and other warnings or information required to ensure the safety of the public. Postings remain at treatment sites for as long as necessary to protect the public.

Mitigation

This PEIS identifies measures that the BLM proposes to implement to mitigate adverse environmental impacts identified in Chapter 4 (Environmental Consequences). These measures are summarized in Table 2-5. As defined by CEQ regulation 1508.20, mitigation includes: 1) avoiding the impact altogether by not taking a certain action or parts of an action; 2) minimizing impacts by limiting the degree or magnitude of the action and its implementation; 3) rectifying the impact by repairing, rehabilitating, or restoring the affected environment; 4) reducing or eliminating the

TABLE 2-5
Mitigation Measures

Resource	Mitigation Measures
Air Quality	None proposed.
Soil Resources	None proposed.
Water Resources and Quality	None proposed.
Wetland and Riparian Areas	None proposed.
Vegetation	• Establish herbicide-specific buffer zones around downstream water bodies, and nearby habitats and non-target plant species/populations of interest for aminopyralid, fluroxypyr, and rimsulfuron. Consult the ERAs for more specific information on appropriate buffer distances under different soil, moisture, vegetation, and application scenarios. • To protect special status plant species, implement all conservation measures for plants presented in the *Vegetation Treatments Using Aminopyralid, Fluroxypyr, and Rimsulfuron on Bureau of Land Management Lands in 17 Western States Biological Assessment* (USDOI BLM 2015). Apply these measures to all special status plant species.
Fish and Other Aquatic Organisms	None proposed.
Wildlife Resources	• When conducting herbicide treatments in or near habitat used by sensitive and listed terrestrial arthropods, design treatments to avoid the use of fluroxypyr, where feasible.
Livestock	None proposed.
Wild Horses and Burros	None proposed.
Paleontological and Cultural Resources	None proposed.
Visual Resources	None proposed.
Wilderness and Other Special Areas	Mitigation measures that may apply to wilderness and special area resources are associated with human and ecological health and recreation. Please refer to the Vegetation, Wildlife Resources, and Recreation sections of Chapter 4.
Recreation	Mitigation measures that may apply to recreational resources are associated with ecological health. Please refer to the Vegetation and Wildlife Resources sections of Chapter 4.
Social and Economic Values	None proposed.
Human Health and Safety	None proposed.

impact over time by preservation and maintenance operations during the life of the action; and 5) compensating for the impact by replacing or providing substitute resources or environments.

The analysis presented in this PEIS assumes that all of the applicable SOPs identified in the 2007 PEIS (USDOI BLM 2007a: Table 2-8) would be followed during herbicide treatments with the three new active ingredients. Additionally, it assumes that all applicable mitigation measures developed in the 2007 PEIS and included in the ROD for that document (USDOI BLM2007b: Table 2-4) would be followed. Therefore, only new mitigation measures specific to aminopyralid, fluroxypyr, and rimsulfuron are presented in this PEIS.

Summary of Impacts by Alternative

Table 2-6 summarizes the likely effects of vegetation treatments using aminopyralid, fluroxypyr, and rimsulfuron for each alternative. Information contained in this table is discussed in more detail in Chapter 4 (Environmental Consequences).

TABLE 2-6
Summary and Comparison of Effects on Resources by Alternative

No Action Alternative	Preferred Alternative	Alternative C	Alternative D
EFFECTS ON AIR QUALITY			
General Effects: None of the predicted emissions by pollutant or state would exceed Prevention of Signification Deterioration (PSD) annual emissions significance thresholds. Particulate matter concentrations from treatments are expected to be substantially lower than National Ambient Air Quality Standard (NAAQS) thresholds, based on modeling. Treatments would result in approximately 206 tpy of total suspended particulates (TSP), 62 tpy of carbon monoxide (CO), and 45 tpy of particulate matter less than 10 microns in diameter (PM_{10}). Total greenhouse gas (GHG) emissions would be 3,350 metric tons carbon dioxide (CO_2) equivalents per year ($MTCO_2e$/yr). Reduction in wildfire risk would benefit air quality.	**General Effects:** Air quality impacts would be similar to those under the other alternatives, as the treatment acreage under all alternatives would be similar. None of the predicted annual emissions by pollutant or state would exceed PSD annual emissions significance thresholds. Treatments would result in approximately 206 tpy of TSP, 62 tpy of CO, and 45 tpy of PM_{10}. Total GHG emissions would be 3,350 $MTCO_2e$/yr. Benefits to air quality associated with a reduction in wildfire risk would be similar to those under the other alternatives.	**General Effects:** Air quality impacts would be similar to those under the other alternatives, as the treatment acreage under all alternatives would be similar. None of the predicted annual emissions by pollutant or state would exceed PSD annual emissions significance thresholds. Emissions of criteria pollutants and GHGs would be similar to those under the other alternatives.	**General Effects:** Air quality impacts would be similar to those under the other alternatives, as the treatment acreage under all alternatives would be similar. None of the predicted annual emissions by pollutant or state would exceed PSD annual emissions significance thresholds. Emissions of criterial pollutants and GHGs would be similar to those under the other alternatives.
Cumulative Effects: The cumulative effects of air quality pollutants from wildfire and prescribed fire, vehicle exhaust, commercial and industrial land uses, and residential heating, among other sources, have contributed to deterioration in air quality. Despite these factors, air quality in the U.S. has continued to improve since the early 1980s. Pollutants of primary concern continue to be particulate matter and ozone. Greenhouse gases emissions in the U.S., however, continue to increase. The acreage and average size of wildfires also continues to increase, contributing larger amounts of air quality pollutants each year. In the future, sources of air quality pollutants will continue to contribute to cumulative air quality emissions, and contributions of GHG emissions will also be cumulative, potentially contributing to climate change. BLM efforts to restore historical fire regimes, native vegetation, and natural ecosystem processes that reduce the frequency and intensity of wildfire should help reduce the future contribution of wildfire pollutants to cumulative air quality impacts. All alternatives would contribute a similar amount to cumulative air quality effects.			
EFFECTS ON SOIL RESOURCES			
Herbicides would be used on approximately 932,000 acres annually. None of the herbicides likely to be used would result in severe effects to soil. Minor effects to soil and soil organisms could occur, but treatments would potentially help reduce populations of invasive species and reduce wildfire risk. Beneficial effects to soil would include improved soil productivity and reduced soil erosion.	Herbicides would be used on approximately 932,000 acres annually. Effects to soil would be similar to those under the No Action Alternative. The new herbicides are not known to cause severe impacts to soil or soil organisms. With addition of the new active ingredients, there may be a reduction in use of active ingredients that are relatively persistent in the soil. Beneficial effects to soil would be similar to those under the No Action Alternative, and could be slightly greater if efficacy of treatments is increased.	Herbicides would be used on approximately 932,000 acres annually. Effects to soil would be similar to those under the other alternatives. Use of new herbicides would be less than under the Preferred Alternative, and use of persistent herbicides would be between the No Action and Preferred Alternatives. Benefits to soil resources could be slightly greater than under the No Action Alternative and slightly less than under the Preferred Alternative.	Herbicides would be used on approximately 932,000 acres annually. Effects to soil would be similar to those under the other alternatives. Overall persistence of herbicides in soil and benefits as a result of treatments would be similar to those under the No Action Alternative.

TABLE 2-6 (cont.)
Summary and Comparison of Effects on Resources by Alternative

No Action Alternative	Preferred Alternative	Alternative C	Alternative D
Cumulative Effects: Past effects to soil resources in the western states are predominantly associated with natural resource extraction, grazing, road construction, timber harvesting, recreation, agriculture, development, wildland fire, and natural disturbances. These factors have resulted in soil erosion and loss of soil productivity on public lands and throughout the West. Future effects associated with these factors are expected to occur, but would be offset, to some degree, by watershed-level restoration treatments by the BLM and other agencies, as well as by other conservation programs. All alternatives would contribute a similar amount to impacts to soil resources. Countervailing effects associated with long-term improvement in soil function and productivity would also be similar under all the alternatives. The number of herbicides used by the BLM with the potential to impact soil resources would be greatest under the Preferred Alternative and Alternative C, and slightly lower under the other alternatives.			
EFFECTS ON WATER RESOURCES AND QUALITY			
Herbicide treatments would continue to have minor impacts to water resources through movement into surface water and groundwater from treatment sites. Herbicides of greatest concern for groundwater contamination are 2,4-D, diquat, bromacil, dicamba, diuron, hexazinone, and picloram. Minor concerns are associated with the use of glyphosate and tebuthiuron. Treatments to manage invasive species and reduce wildfire risk would continue to benefit watersheds.	There would be similar risks to water quality, over the same geographic area, as under the other alternatives. Based on projected amounts of herbicide use, the use of known drinking water contaminants would decrease by 11 percent, and use of a possible groundwater contaminant (imazapic) would decrease by 10 percent. The Preferred Alternative would be similar to the other alternatives in terms of level of benefit to watersheds.	There would be similar risks to water quality, over the same geographic area, as under the other alternatives. Use of known drinking water contaminants and possible groundwater contaminants would decrease by 9 percent relative to the No Action Alternative (1 percent less than under the Preferred Alternative). Alternative C would be similar to the other alternatives in terms of level of benefit to watersheds.	There would be similar risks to water quality, over the same geographic area, as under the other alternatives. Use of known drinking water contaminants and possible groundwater contaminants would decrease by 4 percent relative to the No Action Alternative (6 percent less than under the Preferred Alternative). Alternative D would be similar to the other alternatives in terms of level of benefit to watersheds.
Cumulative Effects: Past effects to water resources are predominantly associated with mining activities, exploration and development of oil resources, agriculture (including use of pesticides), industry, and other human activities. Activities that contribute to water quality pollution and depletion will likely continue in the western U.S. These effects will be offset, in part, by efforts by the BLM and other land management agencies to improve water quality and restore degraded wetland/riparian areas. All of the alternatives would contribute a similar amount to cumulative effects to water quality, as the amount of herbicides applied during treatments would be the same, although there would be some variability in the potential of different herbicides to reach surface water and groundwater. Under the action alternatives, the number of herbicides used by the BLM would be slightly greater than under the No Action Alternative. Countervailing effects associated with herbicide treatments would include long-term improvements in the function of wetlands, riparian areas, streams, and other water bodies.			
EFFECTS ON WETLAND AND RIPARIAN AREAS			
Approximately 10,000 acres of wetland and riparian areas would be treated annually. Herbicide use would continue to be associated with risks for contamination of water and soil, as well as to non-target plant species. Wetlands and riparian areas would continue to benefit from herbicide treatments that target invasive plants, resulting in improvement in functions.	Approximately 10,000 acres of wetland and riparian areas would be treated annually. Herbicides use would continue to be associated with risks for contamination of water and soil, as well as to non-target plant species. Use of glyphosate near wetlands and in riparian areas would likely be reduced with the introduction of aminopyralid. The degree of improvement to the functions of wetland and riparian areas as a result of herbicide treatments would be similar to the other alternatives.	Approximately 10,000 acres of wetland and riparian areas would be treated annually. Herbicide use would continue to be associated with risks for contamination of water and soil, as well as to non-target plant species. Use of glyphosate near wetlands and in riparian areas would likely be reduced with the introduction of aminopyralid. The degree of improvement to the functions of wetland and riparian areas as a result of herbicide treatments would be similar to the other alternatives.	Approximately 10,000 acres of wetland and riparian areas would be treated annually. Herbicide use would continue to be associated with risks for contamination of water and soil, as well as to non-target plant species. Use of glyphosate near wetlands and in riparian areas would likely be reduced with the introduction of aminopyralid. The degree of improvement to the functions of wetland and riparian areas as a result of herbicide treatments would be similar to the other alternatives.

TABLE 2-6 (cont.)
Summary and Comparison of Effects on Resources by Alternative

No Action Alternative	Preferred Alternative	Alternative C	Alternative D
Cumulative Effects: Past effects to wetland and riparian areas in the western U.S. have occurred as a result of natural resource extraction, recreation, dams and diversions, road construction, agriculture, urbanization, and fire exclusion, among other factors. While these factors continue, to varying degrees, ongoing efforts to protect wetlands and riparian areas have reduced their level of impact. Vegetation treatment programs by the BLM and Forest Service, as well as efforts by other agencies, private landowners, and conservation groups, continue to improve the condition of degraded wetland and riparian habitats. Restoring natural fire regimes and native vegetation, and controlling invasive vegetation, would improve wetland and riparian habitat and function, with benefits similar under all the alternatives. Under all alternatives, some herbicides would be released into wetland and riparian areas, and removal of vegetation could have short-term impacts to functions. Contributions to cumulative effects would be similar under all alternatives.			
EFFECTS ON VEGETATION			
The BLM would continue to implement vegetation treatments using herbicides that would have the goal of restoring native and desirable plant communities and natural fire regimes. Short-term adverse effects to non-target vegetation could occur, and treatment design would need to consider special status species and populations. Long-term benefits would include a reduction in the spread of invasive plants and a reduction in the risk of future wildfire.	Herbicide treatments would be implemented in the same locations and with the same goals as under the No Action Alternative, but with more options for managing invasive plants in terms of active ingredients used. Short-term adverse effects to non-target vegetation and risks to sensitive species and populations would be similar to those under the other alternatives. The efficacy of some herbicide treatments could be improved through use of the new active ingredients, which may be more effective at managing target species than currently approved herbicides, and may improve control of populations that have developed a resistance to currently approved herbicides. Therefore, long-term benefits may be greater than under the No Action Alternative.	Herbicide treatments would be implemented in the same locations and with the same goals as under the other alternatives, but with more options for ground-based control of invasive plants than under the No Action Alternative. There would be fewer options for aerial control than under the Preferred Alternative. Short-term adverse effects to non-target vegetation and risks to sensitive species and populations would be similar to those under the other alternatives. The efficacy of some herbicide treatments could be improved through use of the new active ingredients, but only for ground-based treatments. Long-term benefits associated with ground-based treatments would be similar to those under the Preferred Alternative.	Herbicide treatments would be implemented in the same locations and with the same goals as under the other alternatives. Options for managing invasive plants would be greater than under the No Action Alternative but less than under the Preferred Alternative, as rimsulfuron would not be approved for use, so there would be fewer options for management of annual grasses such as cheatgrass and medusahead. Short-term adverse effects to non-target vegetation and risks to sensitive species and populations would be similar to those under the other alternatives. The efficacy of some herbicide treatments could be improved through use of the new active ingredients, but likely fewer than under the Preferred Alternative. Long-term benefits may be greater than under the No Action Alternative, but less than under the other action alternatives.
Cumulative Effects: Past effects to vegetation and native plant communities are predominantly associated with exclusion of fire and alteration of natural disturbance regimes, timber harvest, reseeding and planting programs, and grazing. Human activities have altered native plant communities, and have led to the introduction and spread of invasive plants. Many of these same human activities will continue to do so in the future, with populations of invasive plants continuing to spread and altered disturbance regimes continuing to contribute to large wildfires that further alter vegetation. Herbicide treatments under all alternatives would kill target and non-target species, but would benefit vegetation by controlling invasive plants, restoring native plant communities, and reducing wildfire risk. The types of adverse and beneficial effects would be similar under all alternatives, although the action alternatives may allow the BLM to be more successful at reaching treatment goals by providing additional herbicide options.			

TABLE 2-6 (cont.)
Summary and Comparison of Effects on Resources by Alternative

No Action Alternative	Preferred Alternative	Alternative C	Alternative D
EFFECTS ON FISH AND OTHER AQUATIC ORGANISMS			
There would continue to be toxicological risks to fish and other aquatic organisms (including sensitive species) associated with use of herbicides, with buffers and other SOPs required to protect these organisms from harm. Long-term beneficial effects to aquatic organisms would include improvements in aquatic habitats through management of invasive plants in aquatic habitats, wetlands, and riparian areas, and reduced sedimentation through treatments to reduce the risk of wildfire.	With the introduction of the three new active ingredients, there would be a potential for reduced toxicological risks to fish and other aquatic organisms, relative to the No Action Alternative, from BLM herbicide treatments. Aminopyralid, fluroxypyr, and rimsulfuron have a very low toxicological risk to fish. In some circumstances they would be used instead of currently approved active ingredients with a greater risk, such as picloram and glyphosate. Long-term beneficial effects to aquatic organisms through habitat improvement and reduced fire risk would be similar to those under the other alternatives.	Toxicological risks to fish and other aquatic organisms could be slightly lower than under the No Action Alternative, as there would be slightly less glyphosate and picloram used than under the No Action Alternative, but more than under the Preferred Alternative. Long-term beneficial effects to aquatic organisms through habitat improvement and reduced fire risk would be similar to those under the other alternatives.	Toxicological risks to fish and other aquatic organisms would be similar to those under the No Action Alternative, as the breakdown of herbicide use would be similar, with only a slight reduction in the use of most of the currently approved active ingredients. Long-term beneficial effects to aquatic organisms through habitat improvement and reduced fire risk would be similar to those under the other alternatives.
Cumulative Effects: Past effects to fish and other aquatic organisms are predominantly associated with natural resource extraction; recreation; fire exclusion; construction of roads, dams, and hydropower facilities; agriculture; and urbanization. In Alaska, oil and gas development, and subsistence and recreational fishing, have been the primary factors affecting fish and aquatic resources. These activities will continue into the future, and will continue to contribute to the degradation aquatic habitats and other adverse cumulative effect to fish. These adverse effects will be offset, to some degree, by protective regulations and restoration efforts, driven by goals to improve water quality and regain the proper functioning condition of riparian areas. Additionally, efforts to remove dams and other blockages to fish passage will continue to benefit fish populations. The contribution to cumulative effects would be similar under all of the alternatives. Herbicide treatments would pose toxicological risks to fish and could alter aquatic habitats, but countervailing effects would be associated with long-term improvement in function of aquatic habitats. The action alternatives would entail use of a slightly greater number of active ingredients than under the No Action Alternative.			
EFFECTS ON WILDLIFE			
Herbicide treatments would continue to benefit wildlife, with goals that include improving wildlife habitat, restoring native plant communities, and reducing wildfire risk. There would continue to be toxicological risks to wildlife (including sensitive species) associated with herbicide use, with the greatest concern associated with diuron, diquat, bromacil, and 2,4-D. Their use would account for 10 percent of acres treated.	Benefits to wildlife would be similar to those under the other alternatives, since the total acreage of wildlife habitat treated would be similar. Some increased efficacy of treatments is possible with the introduction of the three new active ingredients. Overall toxicological risks to wildlife could be slightly lower than under the No Action Alternative. Use of active ingredients with the greatest concern for toxicological effects would account for 8 percent of acres treated.	Benefits to wildlife would be similar to those under the other alternatives, since the total acreage of wildlife habitat treated would be similar. Some increased efficacy of treatments is possible with the introduction of the three new active ingredients, but less than under the Preferred Alternative since aerial treatments of the new herbicides would not be allowed. Use of active ingredients with the greatest concern for toxicological effects would account for 9 percent of acres treated.	Benefits to wildlife would be similar to those under the other alternatives, since the total acreage of wildlife habitat treated would be the same. Some increased efficacy of treatments is possible with the introduction of the three new active ingredients, but less than under the Preferred Alternative since use of rimsulfuron would not be allowed. Use of active ingredients with the greatest concern for toxicological effects would account for 8 percent of acres treated, which is the same as under the Preferred Alternative, and slightly lower than under the other alternatives.

TABLE 2-6 (cont.)
Summary and Comparison of Effects on Resources by Alternative

No Action Alternative	Preferred Alternative	Alternative C	Alternative D
Cumulative Effects: The primary factors contributing to habitat loss and modification in the western U.S. include land conversion to agriculture, pastureland, and residential, commercial, industrial and other development; grazing by domestic livestock and wild horses and burros; timber management; fire suppression; and invasion by weeds and other undesirable vegetation. Many of these activities will continue to occur into the future, and will continue to contribute to loss, modification, and fragmentation of habitat, potentially increasing the likelihood of local extirpations of wildlife populations and loss of species diversity. Actions to protect sensitive species and their habitats, restore native plant communities and disturbance regimes, control the spread of invasive species, and reduce the risk of wildfire would all be expected to help offset some of the adverse impacts to wildlife and their habitats. Under all alternatives, herbicide treatments would contribute to cumulative effects to wildlife through habitat modifications and release of herbicides into occupied habitats. Countervailing long-term effects associated with restoration of native plant communities and disturbance regimes would also be similar under all the alternatives. By allowing the BLM the flexibility to use additional herbicides, the action alternatives would result in the release of a larger number of active ingredients. As the three herbicides have a very low risk to wildlife, a cumulative effect of adding these active ingredients could be a reduction in overall risk to wildlife associated with herbicide treatments, as herbicides with a greater risk to wildlife would potentially be used less.			
EFFECTS ON LIVESTOCK			
Herbicide treatments would continue to have some risk for toxicological effects to livestock that graze in treated rangelands. Beneficial effects of herbicide treatments would include long-term improvements to rangeland vegetation through management of noxious weeds, reduction of wildland fire risk, and on some rangelands the seeding of non-target species after the herbicide treatment.	The overall toxicological risk to livestock could be lower than under the No Action Alternative; approximately 7 percent fewer acres would be treated with herbicides that have some level of risk to livestock. Beneficial effects to livestock from improvement of rangeland condition would be similar to those under the No Action Alternative. The new active ingredients could increase the efficacy of certain herbicide treatments.	The overall toxicological risk to livestock could be lower than under the No Action Alternative; approximately 5 percent fewer acres would be treated with herbicides that have some level of risk to livestock. Beneficial effects to livestock from improvement of rangeland condition would be similar to those under the No Action Alternative. The new active ingredients could increase the efficacy of certain herbicide treatments, although not to the same degree as under the Preferred Alternative, since aerial applications of the new herbicides would not be allowed.	The overall toxicological risk to livestock could be lower than under the No Action Alternative. Similar to the Preferred Alternative, approximately 7 percent fewer acres would be treated with herbicides that have some level of risk to livestock. The new active ingredients could increase the efficacy of certain herbicide treatments, although not to the same degree as under the Preferred Alternative, since use of rimsulfuron would not be allowed.
Cumulative Effects: Past effects to livestock are predominantly associated with a decrease in the ability of public lands to support livestock grazing, which has occurred as a result of changes in fire regimes and the spread of noxious weeds. Past livestock grazing has contributed to these adverse effects, as have mineral extraction, recreation, and other activities. Many of these factors are ongoing and will continue to impact the quality of rangelands utilized by livestock. These effects will be minimized or offset by ongoing management programs designed to restore ecosystem processes and maintain livestock populations in balance with the health of rangelands. Under all of the alternatives, herbicide treatments would contribute short-term adverse effects by removing large areas of vegetation and non-target species used by livestock as forage. Countervailing effects of treatments would include improvement in the quality of rangeland forage and controlling noxious weeds that are unpalatable or toxic to livestock. All of the alternatives would be similar as far as the level of their effects. Under the action alternatives, the toxicological risks to livestock associated with herbicide treatments could potentially decrease, as there would be less use of more harmful active ingredients.			

TABLE 2-6 (cont.)
Summary and Comparison of Effects on Resources by Alternative

No Action Alternative	Preferred Alternative	Alternative C	Alternative D
EFFECTS ON WILD HORSES AND BURROS			
Herbicide treatments would continue to have some risk for toxicological effects to wild horses and burros that graze in treated rangelands. Herbicide treatments would continue to benefit wild horse and burros through improvements in the quality of forage on rangelands.	Compared to the No Action Alternative, approximately 7 percent fewer acres would be treated with herbicides that have some level of risk to wild horses and burros. Long-term benefits to rangelands used by wild horses and burros would be similar to those under the No Action Alternative. The addition of the new active ingredients may allow the BLM to more effectively control invasive species and reduce fire risk in certain areas.	Compared to the No Action Alternative, approximately 5 percent fewer acres would be treated with herbicides that have some level of risk to wild horses and burros. Long-term benefits to rangelands used by wild horses and burros would be similar to those under the other alternatives. The addition of the new active ingredients may allow the BLM to more effectively control invasive species and reduce fire risk in certain areas, although they could not be used for aerial applications.	Compared to the No Action Alternative, approximately 7 percent fewer acres would be treated with herbicides that have some level of risk to wild horses and burros, similar to the Preferred Alternative. Long-term benefits to rangelands used by wild horses and burros would be similar to those under the other alternatives. The addition of the new active ingredients may allow the BLM to more effectively control invasive species and reduce fire risk in certain areas, although use of rimsulfuron would be prohibited.
Cumulative Effects: Populations of wild horses and burros decreased drastically in the 1930s and 1940s as a result of capture and removal activities, which were later halted. Presently, the BLM attempts to maintain populations at levels that can be supported by the available resources, but populations continue to be well above that level. Development, grazing, and building of fences and other structures that impede herd movements have all contributed to cumulative adverse effects to wild horses and burros by reducing the quantity or value of available forage. The BLM will continue management efforts to keep wild horse and burro populations in balance with the condition of rangelands, which will require continued removal and adoption of animals, as well as measures to control reproduction. Under all of the alternatives, herbicide treatments would contribute short-term adverse effects by removing large areas of vegetation and non-target species used by wild horses and burros as forage. Countervailing effects of treatments would include improvement in the quality of rangeland forage and controlling noxious weeds that are unpalatable or toxic to wild horses and burros. All of the alternatives would be similar as far as the level of their effects. Under the action alternatives, the toxicological risks to wild horses and burros associated with herbicide treatments could potentially decrease, as there would be less use of more harmful active ingredients.			
EFFECTS ON PALEONTOLOGICAL AND CULTURAL RESOURCES			
Herbicide use would continue to have risks for adversely affecting fossils and cultural resources through chemical exposure and vehicle travel. Native Americans would be at risk for exposure to herbicides through dermal contact, ingestion of treated materials, or swimming in a treated water body. Currently approved herbicides associated with risks to Native American receptors (2,4-D, diquat, and hexazinone) would account for approximately 8 percent of all acres treated. Non-target plants and other subsistence or traditional use resources could potentially be impacted, but there would be long term benefits to these resources through restoration of native habitats and reduction of fire risk.	Risks to paleontological and cultural resources, including subsistence resources, would be similar to those under the other alternatives. The new active ingredients are not associated with human health risks to Native American receptors. Use of currently approved herbicides associated with risks to these receptors would account for approximately 7 percent of all acres treated (just 1 percent lower than the No Action Alternative). Long-term benefits to resources of importance to Native Americans would be similar to those under the other alternatives.	Risks to paleontological and cultural resources, including subsistence resources, would be similar to those under the other alternatives. Use of currently approved herbicides associated with risks to these receptors would be the same as under the No Action Alternative (8 percent; slightly higher than under the preferred Alternative). Long-term benefits to resources of importance to Native Americans would be similar to those under the other alternatives.	Risks to paleontological and cultural resources, including subsistence resources, would be similar to those under the other alternatives. Use of currently approved herbicides associated with risks to these receptors would be the same as under the Preferred Alternative (7 percent). Long-term benefits to resources of importance to Native Americans would be similar to those under the other alternatives.

TABLE 2-6 (cont.)
Summary and Comparison of Effects on Resources by Alternative

No Action Alternative	Preferred Alternative	Alternative C	Alternative D
Cumulative Effects: Past exploration and development in the western U.S. has led to legal and illegal collection of paleontological resources and inadvertent damage of these resources. Many cultural resources have been lost or damaged by the exposure to the elements and by collection or destruction of cultural sites. These losses are permanent, but have been slowed by legislation designed to protect these resources from damage and removal. While the widespread loss and damage of paleontological and cultural resources has been slowed, ground disturbing activities with the potential to disturb undiscovered resources continue to occur in the western U.S. These activities include resource extraction, livestock grazing, and motorized recreation, among others. Over time, additional buried resources may be exposed naturally through erosion, increasing their susceptibility to damage or collection. Additionally, wildfires and invasive species have altered native plant communities, and continue to displace native plants and animals that provide traditional lifeway values to Native peoples. The contribution of herbicide treatments to adverse effects would be similar under all alternatives, with countervailing effects associated with managing invasive species and reducing the risk of wildfire, which would improve conditions for native plants and animals that provide traditional lifeway values. Potential human health risks to Native peoples would be similar under all alternatives, with low use of herbicides with a toxicological risk to humans, and SOPs implemented to prevent exposure.			
EFFECTS ON VISUAL RESOURCES			
Herbicide treatments would continue to have short-term adverse effects on visual resources by removing vegetation and creating a visual contrast to green, untreated vegetation. Long-term benefits to visual resources would be associated with removal of noxious weeds, restoration of native plant communities, and reduction in visual impacts associated with wildfire.	Short-term adverse effects and long-term beneficial effects to visual resources would be similar to those under the other alternatives, as the geographic locations and size of treatments would be similar.	Short-term adverse effects and long-term beneficial effects to visual resources would be similar to those under the other alternatives, as the geographic locations and size of treatments would be similar.	Short-term adverse effects and long-term beneficial effects to visual resources would be similar to those under the other alternatives, as the geographic locations and size of treatments would be similar.
Cumulative Effects: Humans have altered the visual character of lands in the western U.S. through activities such as resource extraction, agriculture, road construction, urbanization and other development, timber harvesting, livestock grazing, introduction of exotic species, and exclusion of fire. As a result, landscapes have changed, and are now marked by different vegetation composition, structure, and pattern. These activities continue to influence visual characteristics and the scenic quality of landscapes. Ongoing vegetation treatment programs would alter the visual quality of public lands over the short term by removing vegetation, and in some cases creating large areas of open, browned, or blackened landscapes. However the BLM's long-term goals to restore degraded lands, reinstate properly functioning ecosystem processes, and restore degraded lands will likely help improve the visual character of public lands. All of the alternatives would have the same degree of effect to visual resources, and the same level of contribution to visual effects. None of the alternatives would alter land uses on public lands, or introduce long-term changes that would be in conflict with the BLM's visual resource management goals. Over the long term, all of the alternatives would be expected to contribute positively to scenic qualities of public lands. Additionally, all of the alternatives would help reduce the risk of wildfire that has a visual impact on public lands and other scenic lands in the western U.S.			
EFFECTS ON WILDERNESS AND OTHER SPECIAL AREAS			
Herbicide treatments would continue to result in some disturbance to wilderness and other special areas, as well as short-term site closures. Long-term benefits would include a reduction in the establishment and spread of invasive species in these areas, which would improve the naturalness component of wilderness character, and a reduced risk of loss of pristine areas to wildfire.	Adverse effects and long-term beneficial effects to wilderness and other special areas would be similar to those under the other alternatives, as the areas receiving treatments and the goals of treatments would be similar. Treatments would improve the naturalness component of wilderness character.	Adverse effects and long-term beneficial effects to wilderness and other special areas would be similar to those under the other alternatives, as the areas receiving treatments and the goals of treatments would be similar. Treatments would improve the naturalness component of wilderness character.	Adverse effects and long-term beneficial effects to wilderness and other special areas would be similar to those under the other alternatives, as the areas receiving treatments and the goals of treatments would be similar. Treatments would improve the naturalness component of wilderness character.

TABLE 2-6 (cont.)
Summary and Comparison of Effects on Resources by Alternative

No Action Alternative	Preferred Alternative	Alternative C	Alternative D
Cumulative Effects: Factors that degrade the unique qualities of wilderness and other special areas include invasive species, wildland fire suppression, loss of water and deterioration in water quality, fragmentation and isolation, loss of threatened and endangered species, deterioration in air quality, motorized and mechanical equipment trespass and use, increasing commercial and public recreation use, adjacent land uses, and urbanization and encroachment. These threats are ongoing, and will continue to impact the unique qualities of wilderness and other special areas. Increases in population and pressure to utilize protected areas for resource extraction may result in further loss or degradation of these areas. Vegetation treatment programs in and near these areas that aim to control the spread of noxious weeds and restore natural fire regimes, if successful, would help reduce some of the threats to wilderness and other special areas, but not others. All of the alternatives would contribute short-term adverse effects associated with site closures and disturbances during herbicide treatments. Countervailing effects associated with slowing future degradation of these areas or improving them through management of invasive species and restoration of native habitats and disturbance regimes would also be the same under all the alternatives.			
EFFECTS ON RECREATION			
Herbicide treatments would continue to be associated with temporary closures of recreation sites and potential human health risks to visitors if accidental exposures occur. Beneficial effects would include improving the condition of sites used for recreation and resources sought during recreation, and reducing risk of wildland fire, which could have longer-term adverse effects to recreation in burned areas.	Adverse effects and long-term beneficial effects to recreation would be similar to those under the other alternatives, as the areas receiving treatments and the goals of treatments would be similar.	Adverse effects and long-term beneficial effects to recreation would be similar to those under the other alternatives, as the areas receiving treatments and the goals of treatments would be similar.	Adverse effects and long-term beneficial effects to recreation would be similar to those under the other alternatives, as the areas receiving treatments and the goals of treatments would be similar.
Cumulative Effects: The BLM provides opportunities for outdoor recreation for millions of visitors annually. However, other uses of BLM lands, such as livestock grazing, timber harvesting, and oil and gas activities, have limited recreation opportunities in certain locations. Additionally, the spread of invasive plants and wildfires have adversely affected recreation opportunities. With the growth of the population in the West and a continued interest in recreation, the amount of use that BLM lands receive by the public will likely to continue to increase. Existing lands and recreational facilities will be used more intensively, potentially reducing the recreation experience in certain areas and resulting in degradation of recreational facilities. Vegetation management programs to improve wildlife habitat quality, control the spread of invasive species, and reduce wildfire risk, will continue to offset some of the impacts caused by recreationists, as well as improve the quality of recreational opportunities on public lands. All alternatives would contribute the same amount to cumulative effects. Short-term adverse effects associated with temporary closures of recreation sites would be offset by long-term beneficial effects associated with management of invasive species, reduction of wildfire risk, and restoration of native plant communities, which would potentially improve recreational experiences.			
EFFECTS ON SOCIAL AND ECONOMIC VALUES			
Social and economic benefits and impacts from herbicide treatments would be similar to what has occurred during the past several years. Herbicide treatments would continue to generate some employment in the geographic areas affected by the treatments. Ongoing consultation with Indian tribes about the location and timing of future treatments would be used to prevent environmental justice effects. Estimated costs to treat vegetation would be approximately $89.1 million per year. Herbicide treatments would continue to	Social and economic benefits and impacts from herbicide treatments would be similar to those under other the other alternatives. Based on estimates of herbicide costs and amount of future use, costs to treat the same amount of vegetation could be 1 to 2 percent lower per year than under the No Action Alternative.	Social and economic benefits and impacts from herbicide treatments would be similar to those under other the other alternatives. Based on estimates of herbicide costs and amount of future use, costs to treat the same amount of vegetation could be less than 1 percent lower per year than under the No Action Alternative.	Social and economic benefits and impacts from herbicide treatments would be similar to those under other the other alternatives. Based on estimates of herbicide costs and amount of future use, costs to treat the vegetation would be similar to those under the No Action Alternative.

TABLE 2-6 (cont.)
Summary and Comparison of Effects on Resources by Alternative

No Action Alternative	Preferred Alternative	Alternative C	Alternative D
provide economic benefits by reducing loss of property to wildfire. Commercial activities that occur on public lands would continue to be impacted a minor amount by herbicide treatments. There would be a risk that herbicide treatments could impact private property and result in damage to crops or other non-target plants of economic value.			
Cumulative Effects: Social and economic factors that are important from the perspective of public lands include the continued population growth in the western U.S., environmental justice concerns associated with communities with high densities of Native Americans and other minority populations, the importance of jobs and industries associated with natural resources and resource extraction, increasing wildfire risks and associated risks to private property, and economic benefits from activities conducted on BLM lands, such as grazing, harvest of timber and other forest products, and oil and gas development. It is expected that populations in the western U.S. will continue to increase, and that use of BLM-administered lands by the public will also continue to increase. Population growth is cumulative, and actions on public lands and elsewhere will continue to affect greater numbers of people, including larger minority and low income populations. BLM lands will continue to provide a source of land for the federal government and local economies, with a possible low-level increase in those benefits through activities to improve the condition of rangelands and other public lands. Oil and gas and mineral resource extraction on public lands are expected to continue to be important sources of income into the future. Recreation is also likely to continue to be an important source of income, with vegetation treatments that improve the quality of public lands for recreation likely to benefit recreational opportunities. It is expected that effects to private property from activities on public lands will be an increasing concern, although efforts by the BLM, Forest Service, and other agencies to reduce wildfire risk may have an overall benefit to private property over the long term if incidence and severity of wildfire is reduced, particularly in the wildland-urban interface. The contribution to cumulative effects to social and economic resources would be similar under all the alternatives, with slight differences in the costs of herbicide treatments.			
EFFECTS ON HUMAN HEALTH AND SAFETY			
Use of herbicides would continue to be associated with some amount of risk to the human health of herbicide applicators and the public. Currently approved herbicides with the greatest amount of associated risk include 2,4-D, bromacil, diquat, fluridone, hexazinone, tebuthiuron, and triclopyr. These herbicides would account of 38 percent of the total treatment acres under the No Action Alternative. Benefits associated with herbicide treatments would include reductions in the occurrence of noxious weeds and a reduced risk of wildfire, which is associated with smoke-related health risks and loss of life and property.	The three new active ingredients have no to low risk to human health (except for accidental occupational exposures to rimsulfuron). However, projected use of higher risk currently approved herbicides would increase slightly, to 40 percent of all treated acres. Benefits associated with herbicide treatments would be similar to those under the other alternatives.	Projected use of herbicides with the greatest amount of human health risk would increase slightly, to 41 percent of all treated acres. Benefits associated with herbicide treatments would be similar to those under the other alternatives.	Projected use of herbicides with the greatest amount of human health risk would increase slightly, to 40 percent of all treated acres, similar to the Preferred Alternative. Benefits associated with herbicide treatments would be similar to those under the other alternatives.

TABLE 2-6 (cont.)
Summary and Comparison of Effects on Resources by Alternative

No Action Alternative	Preferred Alternative	Alternative C	Alternative D
Cumulative Effects: The public and workers have been exposed to human health and safety risks associated with a wide variety of factors, including use of equipment and tools, exposures to chemicals, and wildfire, among others. These will continue to be concerns in the future. Many occupations (such as firefighting and operation of heavy equipment) will continue to be associated with some level of risk, although ongoing actions to reduce health and safety risks will likely help reduce the incidence of injury and illness. The public will continue to be exposed to various pollutants; the cumulative effects of these exposures could include development of cancer and health conditions. Vegetation management programs by the BLM and other agencies to reduce catastrophic fire risk would continue to offset some of the health risk associated with exposure to smoke/wildfire in targeted areas, such as the wildland-urban interface where the most people are likely to be affected. Under all of the alternatives, herbicides with some risk to human health would be applied in similar locations on public lands, although the number of herbicides used and the amounts of usage would vary among the alternatives. Under the action alternatives, two or three new active ingredients would be used, in addition to currently approved herbicides, resulting in a cumulative increase in the number of ingredients used on public lands. The new herbicides have no to very low risk to human health via various exposure scenarios. The potential for synergistic human health effects associated with mixtures of multiple ingredients is not known. Benefits to human health from herbicide treatments would be similar under all the alternatives. Treatments would help reduce wildfire risk and associated risks to human health. Over the long term, restoration of natural fire regimes and improvement in ecosystem health should reduce risks to human health from activities originating on public lands and affecting public land users or those living near public lands.			

CHAPTER 3

AFFECTED ENVIRONMENT

CHAPTER 3

AFFECTED ENVIRONMENT

Introduction and Study Area

This chapter describes the natural and socioeconomic environment of public lands in the western U.S., including Alaska, which would be affected by the alternatives under consideration. It includes the resources that were identified in Chapter 1, and provides a framework for understanding the environmental, cultural, and social consequences of the proposed program and alternatives. In many instances, the sections in this chapter reference material provided in the affected environment chapter of the 2007 PEIS, rather than repeating the full discussions here. However, updated information is provided, where relevant.

Land Use and Ecoregions

Land Use

The BLM manages approximately 247 million acres in the western U.S. and Alaska. Public lands make up less than 0.1 percent of the total land area in some states, up to approximately 68 percent of lands in Nevada (Table 3-1).

The BLM manages activities and resources on rangelands throughout the west to ensure that fundamental rangeland health is being sustained or improved. The BLM permits livestock grazing on public lands in a manner aimed at achieving and maintaining rangeland health.

Other public uses on BLM-administered lands include oil, gas, geothermal, and mineral development, various types of recreation, forestry (harvest of timber and other forest products), and cultural activities. Roads and trails on BLM-administered lands support various forms of travel, including off-highway vehicle (OHV) use and other motorized travel, as well as non-motorized forms of travel such as mountain bike, horse or pack animal, and foot. Rights-of-way provide support petroleum pipelines, electrical transmission lines, and other utilities.

Land use planning is directed by BLM Handbook H-1601-1 (*Land Use Planning Handbook*; BLM 2005). This document provides guidance for preparing, revising, amending, and maintaining land use plans. Land use plans are developed with public input, in accordance with the FLPMA, which requires the BLM to manage public lands and their various resource values to support multiple uses and sustained yields.

TABLE 3-1
Acres of Public Lands in 17 Western States and Percent of the State Administered by the BLM

State	Acres of BLM Land	Percent of State Lands Administered by the BLM
Alaska	72,594,739	20.0
Arizona	12,202,750	16.8
California	15,330,274	15.3
Colorado	8,332,880	12.5
Idaho	11,611,720	21.9
Montana	7,983,412	8.6
Nebraska	6,354	0.2
Nevada	47,794,096	68.0
New Mexico	13,484,412	17.2
North Dakota	58,841	0.2
Oklahoma	1,975	0.2
Oregon	16,135,531	26.1
South Dakota	274,437	0.4
Texas	11,833	<0.1
Utah	22,854,632	43.3
Washington	429,167	0.9
Wyoming	18,373,316	29.4
Total	247,480,369	100

Source: USDOI BLM 2012a. Acreages are approximate and subject to change in response to land transfers.

Ecoregions

Because this PEIS addresses a broad geographic region with a diverse range of biophysical characteristics, the study area has been subdivided into smaller, homogeneous areas for analysis. Where possible, information on resources has been organized by ecoregions rather than by state boundaries. Ecoregions are geographic areas that are delineated and defined by similar climatic conditions, geomorphology, and soils (Bailey 1997, 2002). Since these factors are relatively

constant over time and strongly influence the ecology of vegetative communities, ecoregions may have similar potentials and responses to disturbance (Clarke and Bryce 1997; Jensen et al. 1997). Ecoregions, therefore, provide a useful framework for organizing, interpreting, and predicting changes to vegetation following management treatments.

The public lands addressed in this PEIS lie within eight major physiographic regions, or ecoregion divisions: Tundra, Subarctic, Subtropical Steppe, Subtropical Desert, Temperate Steppe, Temperate Desert, Mediterranean, and Marine, including Mountain Provinces (Map 3-1).

Climate

Climate is the statistical distribution of atmospheric conditions, as determined by the weather patterns that result from long-term fluctuations in global atmospheric and hydrologic cycles. Climatic patterns describe the annual distribution of energy and moisture, thus affecting the amount and seasonal distribution of temperature, precipitation, and winds. These factors influence the composition and distribution of rangeland vegetation, as well as the formation and erosion of rangeland soils, and hydrological conditions. These factors also influence the distribution of wind-borne air pollutants, such as smoke from wildfires and prescribed fires.

The western U.S. experiences several broad climatic groups: polar, boreal, temperate, Mediterranean highland, and dry. Polar and boreal climates dominate in Alaska, while a humid temperate climate is characteristic of the coastal areas of Washington, Oregon, and northern California. The southern California coast has a Mediterranean climate, while mountainous areas have a highland climate. The rest of the western states east of the Cascade, Sierra Nevada, and Rocky mountains are characterized by a dry climate.

The 2007 PEIS presents specific information on the climate within each of the eight ecoregions (USDOI BLM 2007a: 3-2 to 3-4).

Air Quality

Background information on air quality standards and pertinent regulatory information is presented in the 2007 PEIS (USDOI BLM 2007a:3-3 to 3-4). Under the authority of the Clean Air Act, the USEPA sets primary and secondary National Ambient Air Quality Standards (NAAQS) for the criteria pollutants sulfur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), ozone (O_3), lead (Pb), and particulate matter (PM_{10} and $PM_{2.5}$). Primary standards protect the health of sensitive individuals, and secondary standards protect the general welfare of the public.

The most recent NAAQS are listed in Table 3-2. Different averaging periods are established for the criteria pollutants based on their potential health and welfare effects. The NAAQS are enforced by states, which in some cases have adopted additional or more stringent standards. Each state develops a plan describing how it will attain and maintain the NAAQS. Air quality agencies send these plans to the USEPA for approval.

Geographic areas that meet the standards are attainment areas and those that do not meet the standards are nonattainment areas. Nonattainment areas must implement a plan to reduce ambient concentrations below the NAAQS. Once they comply with the standards, they are designated as maintenance areas. Table 3-3 lists counties with public lands that are designated as nonattainment or maintenance areas for each criteria pollutant. PM, O_3, and NO_2 concentrations are expected to be higher near industrial areas and cities where there are significant combustion sources and vehicles. High SO_2 concentrations occur primarily near coal-fired power plants, smelters, and refineries.

Detailed knowledge of the existing air quality for the area covered by this PEIS is limited to available monitoring sites for criteria pollutants. In the undeveloped regions of public lands, ambient pollutant levels are expected to be low, and probably negligible in remote areas. In general, locations experiencing high ambient pollutant levels in the treatment area are areas with commercial and industrial land use (areas with mills, power plants, etc.), and local population centers (areas with automobile exhaust, residential heating, etc.).

Greenhouse Gas Emissions and Climate Change

Climate change is a global issue that refers to any significant change in measures of climate, including temperature, precipitation, or wind, that extends for a period (decades or longer) of time. Climate change is a result of natural factors, such as volcanic eruptions, and anthropogenic, or man-made, factors, including changes in land use and burning of fossil fuels (USEPA

TABLE 3-2
National Ambient Air Quality Impact Significance Criteria

Pollutant	Averaging Period[1]	NAAQS		*PSD Increments*[2]	
		Primary	Secondary	Class I	Class II
NO_2	1-hour	100 ppb	NA	NA	NA
	Annual	53 ppb	53 ppb	2.5 µg/m^3	25 µg/m^3
CO	1-hour	35 ppm	NA	NA	NA
	8-hour	9 ppm	NA	NA	NA
PM_{10}	24-hour	150 µg/m^3	150 µg/m^3	8 µg/m^3	30 µg/m^3
	Annual	NA	NA	4 µg/m^3	17 µg/m^3
$PM_{2.5}$	24-hour	35 µg/m^3	35 µg/m^3	2 µg/m^3	9 µg/m^3
	Annual	12 µg/m^3	15 µg/m^3	1 µg/m^3	4 µg/m^3
SO_2	3-hour	75 ppb	NA	25 µg/m^3	512 µg/m^3
	24-hour	NA	0.5 ppm	5 µg/m^3	91 µg/m^3
	Annual	NA	NA	2 µg/m^3	20 µg/m^3
Lead	Rolling 3-month average	0.15 µg/m^3	0.15 µg/m^3	NA	NA
O_3	8-hour	0.075 ppm	0.075 ppm	NA	NA

[1] Annual standards are never to be exceeded. Short-term standards (those other than annual or quarterly) are not to be exceeded more than once per year, except for O_3, PM_{10}, and $PM_{2.5}$ standards. For O_3, the expected number of days with ozone levels above the standard is not to be exceeded more than once per calendar year. For PM_{10}, the standard is attained when the 99th percentile concentration for the year is less than the standard. For $PM_{2.5}$, the standard is attained when the 98th percentile concentration for the year is less than the standard.

[2] Prevention of significant deterioration (PSD) increments are the maximum amounts of pollutants allowed above a specified baseline concentration. Class I areas are predominantly large national parks and wilderness areas as of August 7, 1977.

NA = Not applicable; ppb = parts per billion; ppm = parts per million; and µg/m^3 = micrograms per cubic meter.

Sources: USEPA 2012b; 40 CFR 52.

2010a). Anthropogenic activities such as deforestation and fossil fuel combustion emit heat-trapping greenhouse gases (GHGs), which are defined as any gas that absorbs infrared radiation within the atmosphere. The heat absorption potential of a GHG is referred to as the Global Warming Potential. Each GHG has a Global Warming Potential value based on the heat-absorbing ability of the GHG relative to CO_2. This value is commonly referred to as carbon dioxide equivalent (CO_2e). Greenhouse gases, both naturally occurring and anthropogenic, prevent heat from escaping the atmosphere and thereby regulate the Earth's temperature. Anthropogenic sources of GHGs have elevated GHG concentrations within the atmosphere, which has led to an increase in the Earth's average surface temperature (USEPA 2010a).

Unlike criteria air pollutants and toxic air contaminants, which are of regional and local concern, GHGs are global pollutants. They have the ability to affect global temperatures due to their heat trapping ability, and are therefore often discussed from a global perspective. There are six recognized GHGs: CO_2, chloroflurocarbons, methane, nitrous oxide (N_2O), O_3, and water vapor. The federal Clean Air Act now regulates these six GHGs. While certain sources are required to meet the USEPA's final GHG Reporting Rule (74 FR 56260; 25,000 metric tons [MT]), other types of projects (including the proposed herbicide treatments) are not required to meet these rules. Draft CEQ guidance for NEPA analysis (which does not apply to land management agencies) uses 25,000 MTCO_2e annual emissions as an indicator for identifying projects that require quantitative and qualitative assessment of GHG emissions (CEQ 2010). For NEPA analysis of the proposed herbicide treatments, it may be useful to compare projected GHG emissions to regional or national GHG emissions to demonstrate the magnitude of programmatic-level impacts.

There are more sources and actions emitting GHGs than are typically encountered when evaluating the emissions of criteria pollutants or toxic air contaminants. The global climate change problem is much more the result of numerous and varied sources,

TABLE 3-3
Counties within the Treatment Area that are Designated Nonattainment or Maintenance Areas for Various Pollutants

Pollutant	State	Nonattainment	Maintenance
$PM_{2.5}$	Alaska	Fairbanks North Star Borough*	None
	Arizona	Pinal*, Santa Cruz*	None
	California	Alameda, Butte*, Contra Costa, El Dorado*, Fresno, Imperial*, Kern*, Kings, Los Angeles*, Madera, Marin, Merced, Napa, Orange, Placer*, Riverside*, Sacramento, San Bernardino*, San Francisco, San Joaquin, San Mateo, Santa Clara, Solano*, Sonoma*, Stanislaus, Sutter, Tulare, Yolo*, Yuba*	None
	Idaho	Franklin*	None
	Montana	Lincoln*	None
	Oregon	Klamath*, Lane*	None
	Utah	Box Elder*, Cache*, Davis, Salt Lake, Tooele*, Utah*, Weber*	None
	Washington	Pierce*	None
PM_{10}	Alaska	Anchorage Municipality*, Juneau City and Borough*	None
	Arizona	Cochise*, Gila*, Maricopa*, Pima*, Pinal*, Santa Cruz*, Yuma*	Gila*, Mohave*
	California	Imperial*, Inyo*, Kern*, Los Angeles*, Mono*, Orange, Riverside*, Sacramento, San Bernardino*	Fresno, Inyo*, Kern*, Kings, Madera, Merced, San Joaquin, Stanislaus, Tulare
	Colorado	None	Adams*, Arapahoe*, Archuleta*, Boulder*, Broomfield, Denver, Douglas, Fremont*, Jefferson, Pitkin*, Prowers*, Routt*, San Miguel*
	Idaho	Bannock*, Bonner*, Power*, Shoshone*	Ada*, Bannock*, Power*
	Montana	Flathead*, Lake*, Lincoln*, Missoula*, Rosebud*, Sanders*, Silver Bow*	None
	Nevada	Clark*, Washoe*	None
	New Mexico	Dona Ana*	None
	Oregon	Lane*	Jackson*, Josephine*, Klamath*, Lake*, Union*
	Utah	Salt Lake, Tooele*, Utah, Weber*	None
	Washington	None	King*, Pierce*, Spokane*, Thurston*, Walla Walla*, Yakima*
	Wyoming	Sheridan*	None
SO_2	Arizona	Pinal*	Cochise*, Gila*, Greenlee*, Pima*, Pinal*
	Montana	Lewis and Clark*, Yellowstone*	None
	Nevada	None	White Pine*
	New Mexico	None	Grant*
	Utah	Salt Lake, Tooele*	None
NO_2	None	None	Los Angeles*, Orange, Riverside*, San Bernardino*
CO	Alaska	None	Anchorage Municipality, Fairbanks North Star Borough*
	Arizona	None	Maricopa*, Pima*

TABLE 3-3 (Cont.)
Counties within the Treatment Area that are Designated Nonattainment or Maintenance Areas for Various Pollutants

Pollutant	State	Nonattainment	Maintenance
CO (cont.)	California	None	Alameda*, Butte*, Contra Costa*, El Dorado*, Fresno*, Kern*, Los Angeles*, Marin*, Napa*, Orange, Placer*, Riverside*, Sacramento*, San Bernardino*, San Diego*, San Francisco, San Joaquin*, San Mateo*, Santa Clara*, Solano*, Sonoma*, Stanislaus*, Yolo*
	Colorado	None	Adams*, Arapahoe*, Boulder*, Broomfield, Denver, Douglas*, El Paso*, Jefferson*, Larimer*, Teller*, Weld*
	Idaho	None	Ada*
	Montana	None	Cascade*, Missoula*, Yellowstone*
	Nevada	None	Carson City*, Clark*, Douglas*, Washoe*
	Oregon	None	Clackamas*, Jackson*, Josephine*, Klamath*, Lane*, Marion*, Multnomah*, Polk*, Washington*
	Utah	None	Utah*, Salt Lake*, Weber*
	Washington	None	Clark*, King*, Pierce*, Snohomish*, Spokane*, Yakima*
Ozone	Arizona	Maricopa*, Pinal*	Pinal*
	California	Alameda, Amador, Areas of Indian Country, Butte, Calaveras, Contra Costa, El Dorado*, Fresno, Imperial, Kern*, Kings, Los Angeles*, Madera, Marin, Mariposa, Merced, Napa, Nevada*, Orange, Placer*, Riverside*, Sacramento, San Bernardino*, San Diego*, San Francisco, San Joaquin, San Luis Obispo*, San Mateo, Santa Clara, Solano*, Sonoma*, Stanislaus, Sutter*, Tehama*, Tulare, Tuolumne, Ventura*, Yolo	None
	Colorado	Adams, Arapahoe, Boulder, Broomfield, Denver, Douglas, Jefferson, Larimer*, Weld*	None
	Nevada	Clark*	None
	New Mexico	None	None
	Oregon	None	None
	Utah	None	None
	Wyoming	Lincoln*, Sublett, Sweetwater*	None
Lead	California	Los Angeles*	None
	Montana	Lewis and Clark*	None

* Only a portion of the county is in nonattainment or maintenance for the pollutant.
Notes: States that are not listed for a particular pollutant do not have counties within the treatment area that are also within nonattainment or maintenance areas for that pollutant.
Source: USEPA 2012c.

each of which might make a relatively small addition to global atmospheric GHG concentrations, but that together have a cumulative effect. Regulatory agencies recognize that GHG emissions from a particular project cannot be tied specifically to climate change impacts, and recommend discussion of GHG emissions from a proposed project in terms of the global context (CEQ 2010).

Class I Areas and Visibility Protection

Under the Clean Air Act, The U.S. has designated certain national parks, wilderness areas, and Indian reservations as Prevention of Significant Deterioration (PSD) Class I Areas (Map 3-2). These areas are considered pristine and are therefore afforded special protection from impacts associated with air pollution. Mandatory Class I areas, which include large national parks and wilderness areas that were in existence on August 7, 1977, are a subset of Class I areas that may

not be redesignated, and are subject to visibility protection regulations. Additional information on policies related to visibility protection is presented in the 2007 PEIS (USDOI BLM 2007a:3-4 to 3-6).

Herbicide Drift

Aerial and ground application of herbicides may transport herbicides through drift, allowing airborne herbicides to move beyond the intended target. The primary factors that influence drift are droplet size, wind speed, humidity, formulation of the herbicide, height of application, equipment and application techniques, and the size of the area treated with the herbicide. The factor that has the greatest influence on downwind movement is droplet size. Procedures that can be employed to reduce drift include: 1) using a lower spray nozzle height, 2) using the lower end of the pressure range, 3) increasing the spray nozzle size, 4) using drift-reducing nozzles, 5) using drift control additives, and 6) using sprayer shields (Hofman and Solseng 2001). Additionally, several university extension service agencies provide assistance regarding SOPs to minimize herbicide spray drift (Dexter 1993, Hofman and Solseng 2001).

Topography, Geology, Minerals, Oil, and Gas

The diversity in the landscape of the treatment areas reflects differences in geologic processes and the effects of climate, which have been shaping the land over a long period of time.

A detailed baseline summary of mineral, oil, and gas resources located within the project area, by ecoregion, is presented in the 2007 PEIS (BLM 2007a:3-6 to 3-7). Map 3-3 presents an update, based on the most recent available digital data, of oil and gas wells on public lands.

In 2011, conventional energy development from public lands produced 43 percent of the nation's coal, 13 percent of domestic natural gas, and 5 percent of the domestically-produced oil. BLM-administered federal coal leases power more than 20 percent of the energy generated in the United States. The BLM is also actively promoting solar, wind, and geothermal energy development on federal lands. Nearly 40 percent of U.S. geothermal energy production capacity is on public lands (USDOI BLM 2012b).

At the end of Fiscal Year (FY) 2012, the BLM administered approximately 47,000 oil and gas leases, of which approximately 23,000 were producing (USDOI BLM 2013b). During 2011, geothermal leases generated more than 4,600 gigawatts of electrical power, and accounted for more than 40 percent of the U.S. geothermal energy capacity (USDOI BLM 2013c).

States within the project area with the largest acreage of public lands in producing status for oil and gas activities are New Mexico, Colorado, Montana, and North Dakota. Between 2006 and 2012, there were substantial increases in the amount of public land in producing status in North Dakota and California, and sizeable decreases in Alaska and Nevada (USDOI BLM 2013a). Coal licenses and leases occur on public lands in Colorado, Montana, New Mexico, Oklahoma, Utah, and Wyoming. Mining operations occur on public lands in the majority of the western states covered by this PEIS, with most mining activity occurring in Nevada.

Soil Resources

Soils in the treatment area are diverse and range from the arid, saline soils of the southwest, to the clayey glaciated soils of Montana, to the cold, wet permafrost soils of Alaska.

Eleven soil orders are represented on public lands in the western U.S. and Alaska (Map 3-4). Because soils develop under local conditions of climate, parent material, and vegetation, each ecoregion may contain several or all of the soil orders as a result of various combinations of local soil forming factors. A detailed description of soils by soil order is presented in the 2007 2007 PEIS (USDOI BLM 2007a:3-7 to 3-9) and is incorporated here by reference. Map 3-4 is a very basic inventory of soil types at the landscape level. More detailed mapping of soils and associated information can be found in individual soil surveys completed for the western U.S., which are available on-line at http://www.nrcs.usda.gov/wps/portal/nrcs/soilsurvey/soils/survey/state/.

The concept of soil quality encompasses a soil's capacity to function. Healthy soils support plant and animal diversity and productivity, air and water quality, and human health (Soil Quality Institute 2001). They filter and buffer pollutants, store and cycle nutrients, and support structures and protect archaeological resources. Soil quality is a function of each soil's inherited properties (texture, type of minerals, and depth) as well as more dynamic properties that can

change with management (porosity, infiltration, effective ground cover, and aggregate stability). The ability of a soil to filter, buffer, degrade, immobilize, and detoxify herbicides is a function of the soil quality.

Soil quality is integrated with the BLM's management activities, which can result in changes in certain soil properties such as soil porosity, organic matter, biological activity, and susceptibility to erosion. These changes in turn affect the fate of herbicides in soils. For example, disturbances that result in increased susceptibility to erosion will affect the off-site movement of certain herbicides that are designed to bind to soil particles. Herbicides can alter soil organism diversity and composition. Compaction or surface disturbance may affect soil-activated herbicides from reaching the root zone of target plants. Soil quality is also considered by the BLM in health score cards used to assess land health.

Biological Soil Crusts

Biological soil crusts (also known as cryptogamic, microbiotic, cryptobiotic, or microphytic crusts) are commonly found in semiarid and arid environments. They are a community of organism at the surface of the soil comprised of cyanobacteria, blue green algae, microfungi, mosses, liverworts, and lichens (Rosentreter et al. 2007). Biological soil crusts provide important functions, such as improving soil stability and reducing erosion, fixing atmospheric nitrogen and contributing nutrients to plants, and assisting with plant growth (Belnap and Gardner 1993, Evans and Ehleringer 1993, Eldridge and Greene 1994, Belnap and Giliette 1998, Harper and Belnap 2001). They also enhance soil fertility and stability. Biological soil crusts occupy open spaces between the sparse vegetation of the Great Basin, Colorado Plateau, Sonoran Desert, and the inner Columbia Basin, and also occur in agricultural areas and native prairies, and in Alaska.

Biological soil crusts can reach up to several inches in thickness and vary in terms of color, surface topography, and surficial coverage. Crusts generally cover all soil spaces not occupied by vascular plants, which may be 70 percent or more in arid regions (Belnap 1994). They are well-adapted to severe growing conditions, but are influenced by disturbances such as compression from domestic livestock grazing, tourist activities (hiking, biking, and OHVs), mechanical treatment and agricultural practices (extensive tillage and planting), application of herbicides, and military activities (Peterjohn and Schlesinger 1990, Belnap 1995, U.S. Geological Survey [USGS] 2004). It is prudent to minimize surface disturbance of soil crusts to prevent invasions of annual fire-adapted grasses and minimize dust produced from disturbance.

Micro and Macroorganisms

The soil microbial community plays a crucial role in maintaining ecosystem health and sustainability, with plant-microbe interactions contributing to the condition of the ecosystem. Microorganisms help to break down and convert organic remains into forms that can be used by plants. Microorganisms, such as mycorrhizal fungi, nitrogen-fixing organisms, and certain types of bacteria assist plant growth, suppress plant pathogens, and build soil structure. There is evidence that certain bacteria in soil may suppress cheatgrass and other invasive species (USFWS 2013). One of the main benefits of mycorrhizal fungi is the improved uptake of nutrients (predominantly phosphorous) and water by plants (Allen 1991). Soil microorganisms are also important in the breakdown of certain types of herbicides.

Macroorganisms, such as insects, earthworms, and small burrowing mammals, mix the soil and allow organic matter on the surface to become incorporated into the soil. These organisms are part of a food web that is essential to the cycling of nutrients within the soil. Soil organisms interact and support plant health as they decompose organic matter, cycle nutrients, enhance soil structure, and control the populations of soil organisms, including pests (Ingham, no date).

Soil Erosion

Soil erosion is a concern throughout the western U.S. and Alaska, particularly in semiarid rangelands. The quantity of soil lost by water or wind erosion is influenced by climate, topography, soil properties, vegetative cover, and land use. While erosion occurs under natural conditions, rates of soil loss may be accelerated if human activities are not carefully managed.

Tundra lands in Alaska are susceptible to erosion if the thick vegetative mat overlying permafrost is disturbed or removed. Trails quickly turn into widely braided ruts, especially in wetlands and at streambank crossings. The resulting gully erosion can rapidly erode substantial quantities of previously frozen soils. Erosion from aufeis (thick ice that builds up as a result of repeated overflow) and anchor ice is also a concern, because of spring breakup flood events leaving disturbed stream

channels. These events cause previously stable riparian areas to form a long-lasting sequence of extensively braided channels, especially in glacial soils.

Rangelands are affected by all four types of water erosion—sheet, rill, gully, and streambank. Sheet erosion is relatively uniform erosion from the entire soil surface and is therefore often difficult to observe, while rill erosion is initiated when water concentrates in small channels as it runs off the soil. Sheet and rill erosion are capable of reducing the productivity of rangeland soils, but often go unnoticed. Gully and streambank erosion is far more visible, and may account for up to 75 percent of erosion in desert ecosystems (Hein 2002).

Wind erosion is most common in arid and semiarid regions where lack of soil moisture greatly reduces the adhesive capability of soil (Brady and Weil 2002). Most wind erosion problems result from bare, exposed soils with weak or degraded soil structure, such as along trails or on sand dunes or disturbed surfaces. In addition to moisture content, soil particle size (texture), mechanical stability of aggregates and clods, and presence of vegetation also affect the ability of wind to move soil.

It is possible to control rates of soil erosion by managing vegetation, plant residues, and soil disturbance. Vegetative cover is the most significant factor in controlling erosion because it intercepts precipitation, reduces rainfall impact, restricts overland flow, and improves infiltration. Biological soil crusts are particularly important for protecting the soil and controlling erosion in desert regions, but are easily disturbed by grazing and human activities. While wind erosion on rangelands is difficult to quantify, the presence of natural vegetation on most rangelands is generally sufficient to keep wind erosion from becoming a serious problem.

In areas treated with herbicides, erosion can lead to movement of herbicides on soil particles. Herbicides bound to soil particles may be moved off site by wind or water erosion events. Soil texture (sand, silt, and clay) and structure affect the movement of water and herbicides through soil, and the amount of herbicide that is likely to be adsorbed by soil. The coarser the soil, the faster the movement of percolating water and the lower the opportunity for adsorption of dissolved chemicals. Soils with more clay and organic matter tend to hold water and dissolved chemicals longer. These soils also have far more surface area onto which herbicides can be adsorbed (LaPrade 1992).

Soil Disturbance

Many western landscapes with undisturbed soils are healthy, stable, and less vulnerable to erosion than areas with disturbed soils. Soil disturbance stimulates erosion, breaks up soil aggregates, and promotes the loss of organic matter.

Soil compaction occurs when moist or wet soil aggregates are pressed together and the pore space between them is reduced. Compaction changes soil structure, reduces the size and continuity of pores, and increases soil density. Large animals, vehicles, and people can cause soil compaction. Generally, soil made up of particles of about the same size compacts less than soil with a variety of particle sizes. Numerous rock fragments can create bridges that reduce compaction. Plant litter and roots, and soil organic matter, structure, moisture, and texture all affect a soil's ability to resist compaction. In areas of rangeland where compaction exists, compacted soil extends generally less than 6 inches below the soil surface, although it can be as deep as 2 feet under heavily used tracks and roads (USDA Natural Resources Conservation Service 1996). Compaction becomes a problem when the increased soil density limits water infiltration, increases runoff and erosion, or limits plant growth or nutrient cycling (Soil Quality Institute 2001).

Water Resources and Quality

Water Resources

Water resources in the western U.S. and Alaska are important for fish and wildlife habitat and a variety of human needs, such as domestic consumption, industrial activities, crop irrigation, livestock watering, and recreation. Numerous legal and policy requirements have been established to manage water resources for these multiple needs, including state law and case law defining water rights, the Clean Water Act, the Colorado River Basin Salinity Control Act, and EO 11988 (*Floodplain Management*).

Water resources are classified as surface water or groundwater. Surface water resources include rivers, streams, lakes, ponds, reservoirs, and wetlands. Major river systems (e.g., Colorado, Columbia, Snake, Missouri, Arkansas, Rio Grande, and Yukon Rivers) and their tributaries are important sources of water in the western U.S and Alaska. Additional discussion of surface water and groundwater resources can be found in the 2007 PEIS (USDOI BLM 2007a:3-15).

As shown on Map 3-5, nine hydrologic regions have been identified in the treatment area: Alaska, Pacific Northwest, California, Upper Colorado, Lower Colorado, Rio Grande, Missouri, Great Basin, and Arkansas-White-Red (Seaber et al. 1987). Most public lands occur in arid to semiarid environments in the Great Basin and Colorado drainage basins. A discussion of these hydrologic regions and their main hydrologic resources is included in the 2007 PEIS (USDOI BLM 2007a:3-11 to 3-15), and is incorporated here by reference.

Groundwaters are more complex than surface waters in that they occur in aquifers that are beyond our sight, can have rapid or extremely slow flow rates, and can recharge or discharge from streams and uplands or alternate between discharging and recharging, depending on a multitude of factors. Groundwaters or aquifers can also become contaminated and can transport contaminants over great distances very rapidly or over thousands of years. Once contaminated, aquifers can also be very difficult to cleanse, either naturally or by remediation. Very shallow aquifers can release contaminants over a matter of days, while very deep aquifers with long flowpaths can take thousands of years to flush, possibly longer if contaminants become bound in the strata.

As populations in the western U.S. increase, water availability has become a concern, particularly during drought conditions. In the Southwest, in particular, ongoing extraction of water from groundwater storage is resulting in depleted aquifers. Additionally, use of surface water is resulting in reduced flows in some streams and rivers. Finally, there is evidence that climate change is resulting in a shift in patterns of precipitation, which could further exacerbate water availability issues in certain areas (USGS 2005a).

Water Quality

Water quality is defined in relation to its specified and/or beneficial uses, such as human consumption, irrigation, fisheries, livestock, industry, or recreation. The quality of surface water is determined by interactions with soil, transported solids (organics and sediments), rocks, groundwater, and the atmosphere.

The BLM has responsibilities to protect water quality in accordance with mandates of the FLPMA and the Clean Water Act, as well as other laws and regulations that pertain to water quality. The BLM cooperates with the USEPA, states, and tribes to meet water quality standards. The BLM must maintain waters for designated beneficial uses, restore impaired water resources in support of their designated beneficial uses, and provide water for public consumption and use (USEPA 2013a).

Section 303(d) of the Clean Water Act requires that water bodies violating state water quality standards and failing to protect beneficial uses be identified and placed on a 303(d) list (USEPA 2013a). The delisting of 303(d) listed streams is a priority of the BLM.

Nonpoint source pollution, the largest source of water quality problems, comes from diffuse or scattered sources rather than from an outlet, such as a pipe that constitutes a point source. Sediment is a nonpoint source of pollution that results from activities such as livestock grazing and timber harvest. Erosion and delivery of eroded soil to streams is the primary nonpoint source pollution problem of concern to the BLM (USDOI BLM 1980).

Additional discussion of water quality pollutants, and a summary of baseline water quality information for water resources in each hydrologic region, are provided in the 2007 PEIS (USDOI BLM 2007a:3-15 to 3-18, Maps 3-6 and 3-7).

In the western U.S., the key water quality issues limiting water usability are the presence of elevated concentrations of naturally occurring constituents (such as dissolved minerals and trace elements such as arsenic), irrigation return flows, mining, and urbanization. Increased salinity in deep aquifers and some surface water bodies in the arid west have made them unsuitable sources of drinking water (USGS 2005a).

Irrigation return flows may contain salts, trace elements, and agrochemicals such as nitrate and pesticides. In certain areas, irrigation water may be reused multiple times, resulting in elevated levels of contaminants such as selenium, boron, arsenic, mercury, and pesticides (USGS 2005a). Herbicides can impact the quality of both surface water and groundwater. Herbicide use in agricultural areas accounts for approximately 70 percent of the total national use of pesticides, and has resulted in the widespread occurrence of these chemicals in agricultural streams and shallow groundwater (USGS 1999).

Abandoned, inactive, and active mines can release highly acidic and toxic mine drainage that contains elevated levels of trace elements. These elements may

also be leached from exposed mine deposits (USGS 2005a).

Urbanization of many areas of the western U.S. has resulted in increased wastewater return flows, as well as increased stormwater runoff from developed areas. Municipal treated wastewater may contain residual herbicides and other pesticides, industrial and household chemicals, and pharmaceuticals. Urban streams also contain elevated concentrations of pesticides used at residences, commercial areas, and public areas (USGS 2005a).

The most recent water quality inventories available are the 2004 National Water Quality inventory (USEPA 2009a) for surface water, and the USGS National Water Quality Assessment (USGS 2002 to 2012) for groundwater. Based on the 2004 inventory, 45 percent of stream miles in the western U.S. are in good biological condition, compared to best-available reference sites, 26 percent are in fair condition, and 28 percent are in poor condition. The most prevalent stressors observed were nitrogen, phosphorus, riparian disturbance, and streambed sediments. Nationwide, the top sources of stream impairment were agricultural activities, hydromodifications (e.g., water diversions, channelization, and dam construction), and unknown or unspecified sources.

Based on the most recent Alaska Water Quality Assessment Report (USEPA 2010b), approximately 30 percent of inventoried river and stream miles are classified as good waters, while approximately 70 percent are classified as impaired waters. The primary causes of impairment are turbidity, fecal coliform, and sedimentation/siltation, with resource extraction and urban runoff/stormwater as the primary sources of impairment.

The USGS National Water Quality Assessment (NAWQA) assesses trends in concentrations of chloride, dissolved solids, and nitrate (USGS 2012). In sampled wells in the western U.S., these pollutants show increasing trends in some areas, relatively stable trends in other areas, and decreasing trends in others. Throughout much of the Great Basin, there is a stable overall trend, with pollutants increasing in some sampled wells but decreasing in others. In California's Central Valley, there is an increasing trend in all three pollutants. In the Subtropical Desert Ecoregion there is an increasing trend in chloride in the Rio Grande Valley of New Mexico, and an increasing trend in dissolved solids in the Rio Grande Valley and Central Arizona basins. Dissolved solid concentrations are also increasing in the Central Columbia Plateau of Washington. In the upper Snake River Basin of Idaho, chloride is increasing but nitrates are decreasing. One other area showing a trend of improvement is the Willamette Basin of Oregon, where nitrate concentrations in groundwater are decreasing.

Pesticides have been detected in streams and groundwater in the western U.S., and are most prevalent in areas with substantial agricultural or urban land uses. The NAWQA has been assessing surface water and groundwater quality since 1991. According to the NAWQA, pesticides are more frequently detected in streams than in groundwater, and more frequently in shallow wells than in deeper wells that tap aquifers. The most commonly detected herbicides in sampled streams, nationwide, include commonly used agricultural herbicides and five herbicides used for nonagricultural purposes, including three currently used by the BLM (2,4-D, diuron, and tebuthiuron; USGS 2006). In groundwater, compounds with relatively high mobility and persistence have been detected most commonly, none of which are currently used by the BLM in its vegetation management programs.

Wetland and Riparian Areas

Wetlands are generally defined as areas inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support vegetation that is typically adapted for life in saturated soil. Wetlands include bogs, marshes, shallows, muskegs, wet meadows, estuaries, and riparian areas. The BLM administers approximately 12.9 million acres of wetlands. Of these, approximately 12.6 million acres are found in Alaska (USDOI BLM 2012a).

Riparian and wetland areas comprise approximately 5 percent of BLM lands (USDOI BLM 2012a). The benefits of these vital areas, however, far exceed their relatively small acreage. The functions of wetland and riparian areas include water purification, stream shading, flood attenuation, shoreline stabilization, groundwater recharge, and habitat for aquatic, semiaquatic, and terrestrial plants and animals (USEPA 2005a).

The BLM defines properly functioning wetlands as those that: 1) support adequate vegetation, landform, or debris to dissipate energies associated with wind action, wave action, and overland flow from adjacent sites, thereby reducing erosion and improving water quality; 2) filter sediment and aid floodplain development; 3)

improve floodwater retention and groundwater recharge; 4) develop root masses that stabilize islands and shoreline features against cutting action; 5) restrict water percolation; 6) develop diverse ponding characteristics to provide the habitat and the water depth, duration, and temperature necessary for fish production, waterbird breeding, and other uses; and 7) support greater biodiversity (Prichard et al. 2003). This assessment does not take into consideration the habitat value of the wetland to fish and wildlife. It also does not directly consider the presence of invasive plant species, although it does assess vegetation characteristics that can be altered by invasive species, such as structural characteristics, age-class distribution, and species diversity.

Ninety-eight percent of wetlands located on BLM land are thought to be functioning properly. In Alaska, 99 percent of wetlands are considered to be in proper functioning condition, in terms of their ability to dissipate energy associated with high-flow events, with the status of the remaining 1 percent unknown. Within the lower 48 states, approximately 58 percent of wetlands are considered to be in proper functioning condition. Approximately 2 percent are considered to be non-functional, 42 percent are functioning at risk, and 26 percent are unknown. Public lands with poorly functioning wetlands tend to be located in the southwestern U.S. For example, 15 percent of the wetland acres in New Mexico and 14 percent of the wetland acres in Arizona are considered non-functional (USDOI BLM 2012a).

Riparian areas, according to the BLM, are green zones along flowing-water features such as rivers, streams, and creeks (Gebhardt et al. 1990). The BLM administers approximately 155,300 miles of riparian habitat in the treatment area. Of this, approximately 107,600 miles are found in Alaska (USDOI BLM 2012a).

It is estimated by the BLM that 42 percent of surveyed riparian areas in the lower 48 states and 100 percent of riparian areas in Alaska are properly functioning, in terms of having adequate vegetation, landform, or large woody debris present to dissipate stream energy associated with high waterflows (USDOI BLM 2012a). Two percent of riparian areas in the lower 48 states are considered non-functional, and 14 percent are functioning but at risk (USDOI BLM 2012a). Poorest functioning riparian areas are found in the southwest, while most riparian areas in Alaska, Colorado, Montana, and Utah function properly.

Vegetation

The composition and distribution of plant communities in the western U.S. have been influenced by many factors, including climate, drought, insects, diseases, wind, domestic livestock grazing, cultivation, browsing by wildlife, and fire (Gruell 1983). Other activities that have an effect on plant communities include development, agricultural production, logging, mineral extraction, reclamation activities, recreational activities, and ROW development including road construction and maintenance. In addition, non-native plant species have invaded native plant communities, resulting in the loss of ecosystem components in portions of the western U.S.

Before European settlement, naturally occurring fire was an important influence on the landscape of the western U.S., and plant communities were adapted to the occasional intense fires that burned over the landscape (Gruell 1983). The exclusion of fire following European settlement has caused significant changes in plant species composition in the western U.S., especially in areas adapted to fire (Swetnam 1990). Where fire-adapted communities previously limited the expansion of pinyon, juniper, and other less fire-tolerant species, exclusion of fire has resulted in expansion of these species into the surrounding ecosystems (Gruell 1983). The circumstance has also contributed to accumulation of hazardous fuels. In rangelands, many vegetation types have altered fire regimes and are experiencing more frequent fires that burn larger, more continuous areas, which has contributed to the expansion of invasive grasses and forbs. Invasive annual grasses have increased the incidence of fires in sagebrush communities adapted to infrequent fires, and have reduce the fire return frequency to such an extent that portions of sagebrush steppe have been converted to grassland.

Vegetation Classification System

In the 2007 PEIS, vegetation within the treatment area was classified into 14 subclasses, consistent with the 1997 National Vegetation Classification Standard (see USDOI BLM 2007a:3-19, Table 3-4). This standard differentiated vegetation on the basis of growth form, life history strategy, and percent of canopy closure or hydrologic influences (Federal Geographic Data Committee 1997), with important subclasses then described by ecoregion (USDOI BLM 2007a:3-19 to 3-25).

In 2008, a new, dynamic standard was adopted (Federal Geographic Data Committee 2008), which the BLM is currently using for all Resource Management Plans. The new standard classifies vegetation based on floristic (species-based) and physiognomic (growth form-based) properties. Table 3-4 summarizes important macrogroups within likely BLM vegetation treatment areas, as well as their associated classes, subclasses, formations, and divisions. The majority of future vegetation treatments are likely to occur within these macrogroups. A complete list of macrogroups within the 17-states analysis area is provided in Appendix D, along with brief descriptions of key macrogroups by ecoregion.

As shown in Table 3-4, the new classification incorporates climate and geographic location into its hierarchy. Original vegetation descriptions in the 2007 PEIS considered ecoregion as well as vegetation classifications. For the sake of clarity and consistency, this PEIS will follow a similar approach to the earlier PEIS for assessing impacts to vegetation. However, the new classification system groupings will be introduced into the analysis as appropriate.

Based on the BLM's past vegetation treatment activities, and future vegetation treatment goals, the following macrogroups, by ecoregion, are the most likely locations of future herbicide treatments. Additional descriptions of vegetation within each ecoregion can be found in the 2007 PEIS (USDOI BLM 2007a:3-19 to 3-25).

Tundra and Subarctic Ecoregions

Only very limited herbicide treatments are currently proposed for macrogroups within these ecoregions, but more may occur in them in the future. Regardless, the vegetation macrogroups in this ecoregion are unlikely to constitute more than a small fraction of the areas receiving herbicide treatments.

Temperate Desert Ecoregion

The Temperate Desert Ecoregion includes the arid shrublands and grasslands of the Great Basin and the Rocky Mountains, as well as lower montane forests and pinyon-juniper woodlands.

As far as locations of likely future herbicide treatments, important macrogroups that occur in the Temperate Desert Ecoregion include shrublands, grasslands, and sagebrush shrubland and steppe. Rocky Mountain and intermountain forests and woodlands are also important, to a lesser degree.

Great Basin and Intermountain Dry Shrubland and Grassland

The shrubland-steppe and grasslands in this macrogroup occur throughout the Colorado Plateau and Arizona-New Mexico Mountains, west to the Mojave Desert, and north to the Wyoming Basin. The shrubland-steppe is either shrub-dominated, dwarf shrub-dominated, or grass-dominated with a sparse shrub layer. The grasslands are located throughout the intermountain western U.S., as a matrix over large areas of intermountain basins and in mosaics with semi-desert shrublands. The dominant perennial bunchgrasses and shrubs of these grasslands are drought-resistant.

Great Basin and Intermountain Tall Sagebrush Shrubland and Steppe

This macrogroup consists of shrublands and shrub-steppe that are widely distributed from the Great Basin, Columbia River Basin, Colorado Plateau, northern Rocky Mountains, and northwestern Great Plains, as far east as the Dakotas. Climate ranges from arid to subhumid. Stands are dominated by Wyoming big sagebrush and basin big sagebrush, sometimes along with other shrub species. The herbaceous layer can be sparse to strongly dominated by graminoids.

Northern Rocky Mountain-Vancouverian Montane and Foothill Grassland and Shrubland

This macrogoup is comprised of shrublands in the lower montane and foothill regions around the Columbia Basin and north and east into the Northern Rocky Mountains, and dry grasslands occurring in the canyons and valleys of the northern Great Basin and Columbia Basin. The shrublands occur within a matrix of low-elevation grasslands and sagebrush shrublands. The grasslands consist of patchy graminoid cover, cacti, and some forbs.

Southern Rocky Mountain Montane Grassland and Shrubland

The shrublands in this macrogroup are dominated by Utah serviceberry, alderleaf mountain mahogany, or Gambel oak. The macrogroup extends from the southern and central Great Plains, southwest to southern New Mexico, extending north into Wyoming, and west into the Intermountain West region.

TABLE 3-4
Vegetation Classification System

Formation Class	Formation Subclass	Formation	Division	Macrogroup
Forest and Woodland	Temperate Forest	Warm Temperate Forest	Southwestern North American Warm Temperate Forest	California Forest and Woodland
				Californian-Vancouverian Foothill and Valley Forest and Woodland
				Madrean Warm Montane Forest and Woodland
			Southwestern North American Warm Temperate Scrub and Woodland	Southern Plains Scrub Woodland and Shrubland
		Cool Temperate Forest	Western North American Cool Temperate Forest	Southern Vancouverian Montane and Foothill Forest
				Vancouverian Lowland and Montane Rainforest
				Northern Rocky Mountain Lower Montane and Foothill Forest
				Southern Rocky Mountain Lower Montane Forest
			Western North American Cool Temperate Woodland and Scrub	Intermountain Singleleaf Pinyon-Western Juniper Woodland
				Rocky Mountain Two-Needle Pinyon-Juniper Woodland
Shrubland and Grassland	Mediterranean Scrub and Grassland	Mediterranean Scrub	California Scrub	California Chaparral
		Mediterranean Grassland and Forb Meadow	California Grassland and Meadow	California Annual and Perennial Grassland
				California Ruderal Grassland and Meadow

TABLE 3-4 (Cont.)
Vegetation Classification System

Formation Class	Formation Subclass	Formation	Division	Macrogroup
Shrubland and Grassland (cont.)	Temperate and Boreal Shrubland and Grassland	Temperate Grassland, Meadow and Shrubland	Western North American Grassland and Shrubland	Northern Rocky Mountain-Vancouverian Montane and Foothill Grassland and Shrubland
				Southern Rocky Mountain Montane Grassland and Shrubland
				Southern Vancouverian Lowland Grassland and Shrubland
			Great Plains Grassland and Shrubland	Great Plains Mixedgrass Prairie and Shrubland
				Great Plains Shortgrass Prairie and Shrubland
			Western North American Interior Sclerophyllous Chaparral Shrubland	Cool Interior Chaparral
				Warm Interior Chaparral
Semi-Desert	Warm Semi-Desert Scrub and Grassland	Warm Semi-Desert Scrub and Grassland	North American Warm Desert Scrub and Grassland	Apacherian-Chihuahuan Semi-Desert Grassland and Steppe
				Chihuahuan Desert Scrub
	Cool Semi-Desert Scrub and Grassland	Cool Semi-Desert Scrub and Grassland	Western North American Cool Semi-Desert Scrub and Grassland	Great Basin and Intermountain Dry Shrubland and Grassland
				Great Basin and Intermountain Tall Sagebrush Shrubland and Steppe

Source: Developed by the BLM based on the Federal Geographic Data Committee Vegetation Subcommittee's National Vegetation Classification Standard, Version 2 (Federal Geographic Data Committee 2008).

Note: This table shows the important vegetation macrogroups. Vegetation treatments may occur in additional macrogroups not shown here (see Appendix D), which comprise a substantially smaller proportion of the proposed treatment acres.

Northern Rocky Mountain Lower Montaine and Foothill Forest

The ponderosa pine woodlands and "wooded steppes" in this macrogroup are located in the foothills of the northern Rocky Mountains in the Columbia Plateau region and west along the foothills of the Modoc Plateau and Eastern Cascades into southern interior British Columbia, and east across Idaho into the eastern foothills of the Rocky Mountains. The woodlands and wooded steppes occur at the lower treeline/ecotone between grasslands or shrublands and more moist coniferous forests, typically on warm, dry, exposed sites. The macrogroup also includes ponderosa pine woodlands that occur along the eastern face of the Rocky Mountains and into the Great Plains.

Southern Rocky Mountain Lower Montane Forest

This macrogroup consists of forests dominated by ponderosa pine, either solely or mixed with other coniferous species. Mixed forests typically have a shrub understory, while forests dominated solely by ponderosa pine typically have a grass-dominated understory.

Intermountain Singleleaf Pinyon-Western Juniper Woodland

This macrogroup consists of pinyon-juniper woodlands that occur on dry mountain ranges of the Great Basin and eastern foothills of the Sierra Nevada. They are dominated by singeleaf pinyon, Utah juniper, or western juniper. This macrogroup includes woodlands that have expanded from their historical ranges into grasslands, steppe, and shrub-steppe habitats, primarily as a result of fire exclusion and livestock grazing.

Rocky Mountain Two-Needle Pinyon-Juniper Woodland

This macrogroup includes pinyon-juniper woodlands that occur on dry mountains and foothills of the Colorado Plateau region, along the east and south foothill slopes of the southern Rocky Mountains and into the plains of southeastern Colorado and northern central New Mexico, on dry mountains and foothills in southern Colorado east of the Continental Divide, and in mountains and plateaus of northern and central New Mexico. Dominant species include two-needle pinyon, Utah juniper, or oneseed juniper. This macrogroup includes some woodlands that have expanded into adjacent grasslands and become denser.

Temperate Steppe Ecoregion

The Temperate Steppe Ecoregion occurs in a semiarid continental climate zone, and includes the Rocky Mountains and the Great Plains. Most of the important macrogroups in this ecoregion also occur in the Temperate Desert Ecoregion and were described in the previous subsection. They include many of the Rocky Mountain grassland, shrubland, and forest, and pinyon-juniper woodland macrogroups listed in Table 3-4 (see Appendix D). Additionally, they include the grassland and shrubland macrogroups of the Great Plains.

Great Plains Mixedgrass Prairie and Shrubland

This macrogroup consists of mesic and dry mixed grass prairies of the Great Plains. On mesic sites they are a mixture of mostly mixed grass prairie with some tallgrass prairie. Graminoids such as western wheatgrass, green needlegrass, big bluestem, and Idaho fescue are dominant. With intensive grazing, cool-season non-native species such as Kentucky bluegrass, smooth brome, and field brome can increase in dominance. Shrub species can increase in dominance with fire suppression. The dry mixed grass prairies occur on flat to rolling topography, and are dominated by moderate to moderately dense medium-tall grasses and scattered shrub.

Great Plains Shortgrass Prairie and Shrubland

This macrogroup includes shortgrass prairies dominated by blue grama and buffalograss, and shrublands dominated by honey mesquite. They occur on flat to rolling uplands, and are characterized by a moderate to dense sod of short grasses, with scattered mid grasses and forbs. The shortgrass prairies occur in the rainshadow of the Rocky Mountains and range from the Nebraska Panhandle south into Texas and New Mexico. The shrublands occur primarily in Texas, Oklahoma, and eastern New Mexico.

Subtropical Steppe

The Subtropical Steppe Ecoregion includes the plateaus and high plains of northern Arizona, New Mexico, and Texas. It supports a semiarid climate, and consists of primarily perennial grassland communities, with some shrublands and woodlands. Macrogroups that are most likely to be targeted by vegetation treatments are Warm Interior Chapparal, Rocky Mountain Two-Needle Pinyon-Juniper Woodland, and Chihuahuan Desert Scrub.

Warm Interior Chaparral

This macrogroup occurs in the northern Chihuahuan Desert and adjacent Sky Islands and Sonoran Desert, extending into limited areas of the southern Great Plains. Vegetation consists of moderately dense to dense grasslands, sometimes with scattered shrubs or succulents.

Rocky Mountain Two-Needle Pinyon-Juniper Woodland

These woodlands have two-needle pinyon, Utah juniper, or oneseed juniper as the dominant species. Within the subtropical steppe ecoregion they occur in mountains and plateaus of northern and central New Mexico.

Chihuahuan Desert Scrub

The Chihuahuan Desert shrublands are concentrated in the extensive desert grassland in foothills and piedmonts of the Chihuahuan Desert, extending into the Sky Island region to the west. Areas occupied by this macrogroup generally saw a shift from the original perennial grasslands to shrub-dominated communities. Possible causes of the shift include livestock grazing, climatic change, and fire suppression. Vegetation consists of desert scrub species, with honey mesquite or velvet mesquite and succulents as dominants.

Subtropical Desert

The Subtropical Desert Ecoregion occupies southeast California, southern Nevada, Arizona, New Mexico, and western Texas, and includes the Chihuahuan, Sonoran, and Mojave Deserts. Vegetation is adapted to dry conditions, and includes numerous xerophytic plants. Since only a small fraction of the BLM's herbicide treatments occur in this ecoregion, no discussion of individual macrogroups is presented here. This information can be found in Appendix D.

Mediterranean

The Mediterranean Ecoregion Division occupies most of California (excluding deserts in the southeastern portion of the state) and a portion of southern Oregon. It supports chaparral communities, coniferous forests, and oak woodlands, among other vegetation types. Based on the BLM's treatment program goals, important macrogroups in this ecoregion are certain forests and woodlands.

California Forest and Woodland

This macrogroup consists of savannas, woodlands, and forests dominated by Californian endemic oak and conifer species. These habitats occur almost entirely within California below 8,000 feet.

Californian-Vancouverian Foothill and Valley Forest and Woodland

These forests and woodlands occur along the Pacific Coast lowlands from southern California to southern British Columbia. They occur inland from the coast, in the dry interior lowland valleys, and are drought tolerant.

Southern Vancouverian Montaine and Foothill Forest

The forests and woodlands of this macrogroup occur in the foothills and lower montane elevations of the southern Cascade and Klamath Mountains, the Modoc Plateau, and the Sierra Nevada, Peninsula, and Transverse Ranges. This macrogroup covers a broad range of elevations. It includes dry montane Jeffery pine-ponderosa pine woodlands, Sierran mixed conifer woodlands, and mixed conifer woodlands tolerant of serpentine soils, among others.

Marine

The Marine Ecoregion Division occupies the Cascade and Coast Ranges of western Washington and Oregon, and the coast mountains of southeastern Alaska, along the Pacific Coast. The mild, rainy climate produces conditions that are hospitable for dense forest communities, which are characteristic of this region. Most treatments are in ROWs where the vegetation is managed in an early seral condition. Since only a small fraction of the BLM's herbicide treatments occur in this ecoregion, no discussion of individual macrogroups is presented here. This information can be found in Appendix D.

Noxious Weeds and other Invasive Vegetation

Invasive plants are non-native species that may cause physical or environmental damage or have other adverse effects on humans. Invasive plants include noxious weeds, which are designated by federal, state, or county government as injurious to public health, agriculture, recreation, wildlife, or property. Infestations of invasive plants are capable of degrading wildlife

habitat; reducing plant and animal diversity; displacing many threatened and endangered species; and reducing opportunities for hunting, fishing, camping and other recreational activities; and may cost millions of dollars in treatments and loss of productivity to land owners. Besides ecological and economic costs, invasive plants can cause impacts to public safety. A few native species, such as junipers, exhibit similar behavior, contributing to hazardous fuels and reducing groundwater through evapotranspiration.

The 2007 PEIS discusses the traits of invasive plants and their mechanisms of invasion (USDOI BLM 2007a:3-26 to 3-27).

BLM Infestations

The estimated rate of weed spread on public lands is 4,300 acres per day (USDOI BLM 2012c). An estimate of weed spread on all western federal lands is 10 percent to 15 percent annually (Asher and Dewey 2005).

Table 3-5 shows gross estimates of acres of infestation of key invasive plant species targeted for treatment by the BLM. These estimates were compiled by the BLM from data provided by individual field offices during a 2014 inventory. Based on this inventory, total estimated acres of invasive plant infestations on public lands in the western U.S. states exceeds 79 million acres (more than 30 percent of total land acres). States with the largest infestations are Nevada, Oregon, Utah, and Idaho. The most prevalent invasive plant species are annual grasses, which represent nearly 70 percent of the total infested areas. Other species/groups that occupy more than 100,000 acres include thistles, halogeton, knapweeds, woody species (Russian olive and tamarisk), mustards (hoary cress, perennial pepperweed, and Dyer's woad), leafy spurge, toadflaxes, and starthistles. The BLM treated approximately 260,000 to 436,000 acres of invasive plants using herbicides during 2006 through 2012. States with the greatest acreage treated during this time period were New Mexico, Idaho, Wyoming, Nevada, and Oregon.

Vegetation Condition and Fire Regimes

The Fire Regime Condition Class (FRCC) is used by the BLM to help describe common issues on public lands, such as altered disturbance regimes, invasive species, or highly altered plant communities. The FRCC classifies land based on the degree of departure from historical fire regimes.

The BLM currently uses the Fire Regime Condition Class Mapping Tool, Version 2.2.0, to determine and map FRCC on public lands. The FRCCs reflect the current conditions' departure from modeled reference conditions. Three FRCCs have been defined, as follows (National Interagency Fuels Technology Transfer 2010):

Condition Class 1 lands (approximately 58.9 million acres of public lands) are within the natural or historical range of variation, and risk of losing key components is low. Vegetation attributes (composition and structure) are intact and functioning.

Condition Class 2 lands (approximately 84.6 million acres) have fire regimes that have been moderately altered from their historical conditions. They experience either an increased or decreased fire frequency of one or more return intervals, potentially resulting in moderate changes in fire and vegetation attributes.

Condition Class 3 lands (approximately 82.6 million acres) have fire regimes that have been substantially altered, and the risk of losing key components to fire or other causes is high. Fire frequencies may have departed by multiple return intervals from historical fire regimes, potentially resulting in dramatic changes in fire size, intensity, and severity, as well as changes in landscape patterns. Vegetation attributes have been substantially altered.

Map 3-6 shows the breakdown of FRCCs on public lands. Note that not all public lands fall into one of these categories. Based on Vegetation Condition Class data from Landfire (2010 and 2011), more than 58 percent (48 million acres) of the Condition Class 3 lands occur in the Temperate Desert Ecoregion, which is a substantial increase from the 21 million acres reported in the 2007 PEIS (USDOI BLM 2007a:3-29). Approximately 18 million acres (21.5 percent) of Condition Class 3 lands occur in the Subtropical Desert Ecoregion, which is a slight increase from the number reported in the 2007 PEIS. Condition Class 3 areas are less prevalent in the remaining ecoregions: 4.9 million acres occur in the Temperate Steppe Ecoregion, 3.2 million acres occur in the Subtropical Steppe Ecoregion, 3.1 million acres occur in the Subarctic Ecoregion, 3.0 million acres occur in the Tundra Ecoregion, 1.5 million acres occur in the Mediterranean Ecoregion, and 0.67 million acres occur in the Marine Ecoregion.

TABLE 3-5
Estimated Acres of Invasive Plant Infestations on Public Lands in 2014

State	Annual[1] Grasses	Halogeton	Knapweed Complex[2]	Starthistles[3]	Mustards[4]	Leafy Spurge	Thistles[5]	Toadflaxes[6]	Woody Species[7]	Total
Alaska	604	--	--	--	1	--	8	40	--	**653**
Arizona	1,009,649	29	10	319	18	--	5,528	--	2,326	**1,017,879**
California	4,395,500	25	5,012	15,097	255,071	1	13,112	313	347,108	**5,031,239**
Colorado	1,567,736	115,683	24,533	3	8,248	602	279,372	9,138	7,519	**2,012,834**
Idaho	5,373,002	45,805	1,435,775	11,451	40,800	242,500	162,651	8,915	17,425	**7,338,324**
Montana	231,979	1,120	149,839	--	6,135	124,859	348,217	233,620	978	**1,096,747**
Nevada	25,929,222	4,300,150	9,474	2,120	27,927	2,502	38,825	12	190,886	**30,501,118**
New Mexico	570,700	67,010	851	10,091	71	20	1,182	10	42,687	**692,622**
Oregon	6,602,000	1,000	261,520	105,000	404,000	1,000	13,020,710	2,000	104,000	**20,501,230**
Utah	7,596,812	2,664,244	13,580	6	2,458	300	13,290	10	384,367	**10,675,067**
Wyoming	285,343	1,308	12,104	--	4,833	24,117	24,856	647	15,158	**368,366**
Total	**53,562,547**	**7,196,374**	**1,912,698**	**144,087**	**749,562**	**395,901**	**13,907,751**	**254,705**	**1,112,454**	**79,236,079**

[1] Annual grasses include cheatgrass, red brome, buffelgrass, common Mediterranean grass, and medusahead rye.
[2] Knapweed complex includes Russian, spotted, diffuse, and squarrose knapweed.
[3] Starthistles include Maltese and yellow starthistle.
[4] Mustards include hoary cress, perennial pepperweed, and Dyer's woad.
[5] Thistles include Canada, bull, plumeless, musk, Italian, and Scotch thistle.
[6] Toadflaxes include dalmatian and yellow toadflax.
[7] Woody species include Russian olive and tamarisk.
Note: North and South Dakota data are included in Montana data, Nebraska data are included in Wyoming data, Oklahoma and Texas data are included in New Mexico data, and Washington data are included in Oregon data.
Source: BLM 2014 invasive plant species inventory.

The fire regime group is another mapping tool utilized by the BLM that characterizes the presumed historical fire regimes within landscapes based on interactions between vegetation dynamics, fire spread, fire effects, and spatial context (Barrett et al. 2010). A natural fire regime is a general classification of the role fire would play across a landscape in the absence of modern human mechanical intervention (Agee 1993; Brown 1995 in Barrett et al. 2010). Five natural fire regime groups have been developed based on the average number of years between fires, combined with fire severity (Barrett et al. 2010):

Fire Regime Group 1 – 0 to 35 year frequency, low to mixed severity.

Fire Regime Group II – 0 to 35 year frequency, replacement severity.

Fire Regime Group III – 35 to 200 year frequency, low to mixed severity.

Fire Regime Group IV – 35 to 200 year frequency, replacement severity.

Fire Regime Group V – 200+ year frequency, any severity.

More fire is generally desired in groups I through III where fire was historically more frequent. In groups IV and V, too much fire has generally occurred on BLM lands and fire-adapted invasive plant species are prevalent.

Of the public lands categorized under the fire regime group classification, the majority (66 percent) are in group IV or V, with 44 percent in groups I through III. Most public lands where fire is occurring much more frequently than historically are found in the Temperate Steppe (45 percent) and Temperate Desert (30 percent) ecoregions.

Non-timber and Special Forest Products

Special forest products include plant materials, fungi, and bryophytes (mosses, liverworts, and hornworts). They consist of firewood, biomass, medicinal plants (e.g., ginseng and goldenseal), wild foods (e.g., mushrooms, berries, roots, and syrups), decoratives and floral greens (e.g., salal, ferns, and evergreen boughs), flavors and fragrances (e.g., sassafras and balsam fir), fibers (e.g., cedar bark, sweetgrass, and lichens), wild native seeds, and transplants for restoration and nursery stock. Special forest products are harvested for a variety of reasons, including subsistence, cultural, spiritual, commercial, recreational, and educational purposes.

During FY 2011, approximately $270,000 worth of non-timber forest products were sold by the BLM in western states. The actual value of non-timber forest products harvested on public lands is substantially greater (USDOI BLM 2012a). Nearly half of non-timber forest product sales on public lands were in western Oregon, and about 18 percent were in Nevada. Other important states for non-timber forest product sales are Colorado and Utah.

Special Status Species

BLM special status species are: 1) species listed or proposed for listing under the ESA, and 2) species requiring special management consideration to promote their conservation and reduce the likelihood and need for future listing under the ESA. BLM policy states that BLM actions must not adversely impact special status species. There are more than 150 plant species occurring on or near public lands in the treatment area that are federally listed as threatened or endangered, or proposed for listing. The number may change over time depending on future evaluations of each species' status. Special status plant species are distributed throughout the western U.S., including Alaska. A list of these species can be found in Appendix E.

For this PEIS, the BLM has consulted with the USFWS and NMFS on listed species and species proposed for listing, and their critical habitats, that could be affected by the proposed treatments. As part of the consultation process, the BLM prepared a *Biological Assessment for Vegetation Treatments with Aminopyralid, Fluroxypyr, and Rimsulfuron on Bureau of Land Management Lands in 17 Western States* (BA), which provides a description of the distribution, life history, and current threats for each species (USDOI BLM 2015). Information contained in the BA will be used as a guideline by BLM field offices when developing local projects.

Fish and Other Aquatic Organisms

The BLM administers lands directly affecting almost 117,000 miles of fish-bearing streams and almost 3 million acres of reservoirs and natural lakes (USDOI BLM 2012b). These habitats range from isolated desert

springs of the Southwest to large interior rivers and their numerous tributaries.

Key fish species that occur in aquatic habitats in or adjacent to BLM-administered lands are discussed in the 2007 PEIS, by geographic region (USDOI BLM 2007a:3-30 to 3-35).

Special Status Species

Nearly 80 aquatic animal species occurring on or near public lands are federally listed as threatened or endangered, or are proposed for future listing. Included in the total number are 61 species/subspecies of fish, 11 species of mollusk, and 7 aquatic arthropods. A complete list of these special status species can be found in Appendix E. Please note that this list is dynamic, and will likely change throughout the time period considered by this PEIS.

Special status aquatic animal species are found on public lands throughout the U.S. Numerous listed salmon populations are found in rivers of the Pacific Coast states. In arid habitats, many special status fish species are found in the rare and fragile desert wetlands and springs, as well as in the major rivers such as the Colorado and the Rio Grande. In the deserts of the Great Basin and Colorado Plateau, terminal lakes, marshes, and sinks provide important habitats for special status fish species that are adapted to their warm, saline conditions.

Special status mollusks occur predominantly in the Snake River of Idaho, and in thermal habitats and small springs and wetlands in New Mexico, Arizona, and Utah. Aquatic arthropods of special concern occur predominantly in the vernal pools of California.

Wildlife Resources

Public lands sustain an abundance and diversity of wildlife and wildlife habitat. Public lands provide a permanent or seasonal home for more than 3,000 species of amphibians, reptiles, birds, and mammals.

Wildlife populations are found in areas where their basic needs—food, shelter, water, reproduction, and movement—are met. The area in which the needs of a particular population are met is its habitat. Many animals have special behaviors and physical traits that allow them to successfully compete with other animals in only one or a few habitats; many threatened and endangered species fall into this category. Other animals, such as mule deer, coyote, and American robin are less specialized and can use a wider range of habitats.

Several features make some habitats better for wildlife than others. In turn, the more of these features that are present, the greater the diversity of wildlife species that are likely to be present. These features include:

- Structure – shape, height, density, and diversity of the vegetation and other general features of the terrain.
- Vertical layers – layers of vegetation (e.g., herbaceous, shrub, and forest canopy).
- Horizontal zones – vegetation and other habitat features that vary across an area.
- Complexity – an integration of vertical layers and horizontal zones.
- Edge – the area where two types of vegetative communities meet, such as a forest and shrub community.
- Special features – unique habitat features needed for survival or reproduction, including snags (dead trees), water, and rock outcrops.

For inventory and management purposes, the BLM divides wildlife habitat based on land cover types: Outside of Alaska, the vast majority of wildlife habitat is in the shrub-scrub category, with herbaceous and evergreen forest the next most abundant habitat types. In Alaska, dwarf shrub, shrub-scrub, evergreen forest, and sedge/herbaceous are the most abundant habitat types (USDOI BLM 2012a).

The BLM inventories a portion of its rangelands. The BLM's Rangeland health standards include levels of physical and biological condition or degree of function required for healthy lands and sustainable uses, as defined in BLM Handbook H-4180-1 (*Rangeland Health Standards*; USDOI BLM 2001). Of lands that have been inventoried for rangeland health, 56 percent are rated as meeting standards for rangeland health or making significant progress toward meeting these standards. The remaining 44 percent of evaluated lands do not meet rangeland health standards, or are not making significant progress toward meeting the standards for various reasons. Livestock have been determined to be a significant factor affecting rangeland health on 29 percent of inventoried lands (BLM 2013d).

Based on a 2006 report, approximately 26 percent of BLM-administered lands are forested. The most common forest habitats are pinyon-juniper woodlands, juniper woodlands, and Douglas-fir forests (USDOI BLM 2006).

The BLM manages vegetation to improve wildlife habitat. Plants, which are an important component of habitat, provide food and cover. Food is a source of nutrients and energy, while cover reduces the loss of energy by providing shelter from extremes in wind and temperature, and also affords protection from predators. The important characteristics of wildlife and habitat in the eight ecoregions that comprise the treatment area are presented in the 2007 PEIS (USDOI BLM 2007a:3-36 to 3-43).

Special Status Species

There are 65 terrestrial animal species occurring on or near public lands in the treatment area that are federally listed as threatened or endangered, or proposed for listing. Included in the total number are 9 species of arthropod, 7 species of amphibian, 5 species of reptile, 16 species of bird, and 28 species of mammal. A complete list of special status animal species may be found in Appendix E. Please note that this list is dynamic, and will likely change throughout the time period considered by this PEIS.

Special status animal species are found on public lands throughout the U.S. Special status arthropods are largely butterflies that occur mostly in open habitats. Special status amphibians occur in wetland habitats throughout the West, and special status reptiles occur in warm habitats of California and the southwest. Special status birds and mammals use a wide range of habitats found on public lands throughout the western U.S.

Livestock

Approximately 155 million acres of public lands are available for livestock grazing. The majority of the grazing permits issued by the BLM involve grazing by cattle, with fewer and smaller grazing permits for other kinds of livestock (primarily sheep and horses).

The BLM administers grazing lands under 43 CFR Part 4100 and BLM Manual MS-4100 (*Grazing Administration – Exclusive of Alaska*; USDOI BLM 2009a). For management purposes, lands that are available for livestock grazing are divided into allotments and pastures. The BLM administers nearly 18,000 permits and leases for grazing on more than 21,000 allotments under BLM management. Permits and leases generally cover a 10-year period and are renewable if the BLM determines that the terms and conditions of the expiring permit or lease are being met. The grazing permit establishes the allotment(s) to be used, the total amount of use, the number and kind of livestock, and the season of use. The grazing permit may also contain terms and conditions as appropriate to achieve management and resource condition objectives. Allotment management plans further outline how livestock grazing is managed to meet multiple-use, sustained-yield, and other needs and objectives, as determined through land use plans.

Geographically specific rangeland health standards and guidelines are identified for each state to help direct the grazing program for those states. The BLM conducts reviews of land within its jurisdiction to determine the level of compliance with rangeland health standards. As of 2012, the BLM had inventoried approximately 126 million acres of rangeland. As stated previously, approximately 56 percent of inventoried rangelands are meeting all standards for rangeland health or making significant progress toward meeting these standards (BLM 2013d).

Public lands provide forage for many ranches and help to support the agricultural component of many communities scattered throughout the West. As of October 2011, the total number of grazing permits/leases in force was 17,694, with a total of 12.4 million Animal Use Months (AUMs) authorized (Table 3-6; USDOI BLM 2012a). There has been a gradual decrease in the amount of grazing on BLM-administered lands, from 18.2 million AUMs in 1954 to 8.9 million AUMs in 2012 (USDOI BLM 2013e). In most years the actual use of forage is less than the amount authorized.

Wild Horses and Burros

The BLM, in conjunction with the Forest Service, manages wild horses and burros on BLM- and Forest Service-administered lands through the *Wild Free-Roaming Horse and Burro Act of 1971*. As of June 2014, the free-roaming wild horse and burro population was approximately 49,200 animals, with another 48,000 animals held in holding pens (Table 3-7; USDOI BLM 2014a). The population of free-roaming wild horses and burros is nearly 22,500 animals above the Appropriate Management Level (AML) of 26,500. The AML is an estimate of the number of wild horses and burros that

can graze on public lands without causing damage to the range.

TABLE 3-6
Grazing Permits and Leases in Force and Active Animal Unit Months in 2011

State	Leases and Permits	Active AUMs
Arizona	770	642,288
California	526	314,442
Colorado	1,471	584,901
Idaho	1,866	1,352,781
Montana	3,764	1,269,161
Nebraska	18	592
Nevada	684	2,120,374
New Mexico	2,272	1,847,960
North Dakota	79	9,279
Oklahoma	4	132
Oregon	1,231	1,023,040
South Dakota	472	73,223
Utah	1,452	1,190,920
Washington	265	33,073
Wyoming	2,820	1,925,583
Total	17,694	12,387,749

Source: BLM Public Land Statistics (USDOI BLM 2012a).

Animals are managed within 179 wild horse and burro Herd Management Areas (HMAs; USDOI BLM 2012b). Wild horse herds grow at an average rate of 20 percent annually. Management is accomplished by carefully controlling horse and burro populations so that their numbers do not exceed the carrying capacity of the land. This is done primarily by gathering animals periodically so that numbers are near the AML. Fertility control is being used in some HMAs as a means to reduce the population growth rate.

When horse and burro populations begin to exceed the AML, excess animals are gathered and offered to the public through periodic adoption. In FY 2011, 2,844 wild horses and burros were adopted in the U.S. Thirty-three percent of these were adopted in the eastern U.S. More than 227,000 animals have been adopted since 1971 (USDOI BLM 2012a). Public lands inhabited by wild horses or burros are closed to grazing under permit or lease by domestic horses and burros. The *Wild Free-Roaming Horse and Burro Act* of 1971 mandates that wild horses and burros can only be managed in areas where they were found in 1971. Those that stray onto non-designated public and/or private lands are removed.

Paleontological and Cultural Resources

Paleontological Resources

The BLM is responsible for managing public lands and their various resources so that they are utilized in a manner that will best meet the present and future needs of this Nation. The western U.S. has a fossil record that includes almost all of the geologic periods from the Cambrian (500+ million years ago) to the Holocene (Recent; from approximately 11,000 years before present [BP]), and nearly every imaginable ancient environment. Many fossil deposits are of national and international importance. It is estimated that there are more than 50,000 fossil sites documented on public lands. More information on paleontological resources and their management is provided in the 2007 PEIS (USDOI BLM 2007a:3-45 and Table 3-8).

Cultural Resources

Cultural resources include archaeological, historic, or architectural sites, structures, or places with important public or scientific uses, and may include definite locations (sites or places) of traditional cultural or religious importance to specific social or cultural groups. The BLM locates, classifies, and ranks cultural resources, and manages them according to their relative importance, to protect significant cultural resources from inadvertent loss, destruction, or impairment, and to encourage and accommodate the appropriate uses of these resources through planning and public participation.

The cultural heritage for public lands administered by the BLM in 17 western states extends back to approximately 13,000 years BP. As one moves forward in time, the number and variety of sites increases mainly as a result of the increase in Native populations and, after 500 BP or so, European and Euroamerican immigration.

Table 3-8 summarizes the number of acres of public lands inventoried for cultural resources, the number of properties found on public lands, and the number of properties listed in the National Register of Historic Places (NRHP).

TABLE 3-7
Wild Horses and Burros on Public Lands in Fiscal Year 2013

State	Wild Horses	Wild Burros	Total	Maximum AML
Arizona	333	4,411	4,744	1,676
California	4,086	1,922	6,008	2,184
Colorado	1,205	0	1,205	812
Idaho	668	0	668	617
Montana, North Dakota, and South Dakota	160	0	160	120
Nevada	23,347	1,688	25,035	12,796
New Mexico, Oklahoma, and Texas	146	0	146	83
Oregon and Washington	3,120	60	3,180	2,715
Utah	3,979	313	4,292	1,956
Wyoming and Nebraska	3,771	0	3,771	3,725
Total	40,815	8,394	49,209	26,684

Source: USDOI BLM 2014a.

TABLE 3-8
Cultural Resources on Public Lands

State	Number of Acres (in millions)	Number of Acres Surveyed	Percent of Acres Surveyed	Number of Properties Recorded
Alaska	72.4	179,759	0.2	3,831
Arizona	12.2	980,953	8.0	13,953
California	15.3	2,135,675	14.0	34,522
Colorado	8.3	1,838,771	22.2	47,035
Idaho	11.6	2,581,358	22.3	17,753
Montana, North Dakota, and South Dakota	8.3	1,522,922	18.3	11,389
Nevada	47.8	3,000,829	6.3	57,688
New Mexico, Oklahoma, and Texas	13.6	1,771,607	13.0	39,209
Oregon and Washington	16.5	1,880,146	11.4	15,578
Utah	22.8	2,794,218	12.3	50,679
Wyoming and Nebraska	18.4	3,249,624	17.7	49,424
Total	247.2	21,935,862	8.9	341,061

Source: BLM Public Land Statistics (USDOI BLM 2008b, 2009b, 2010a, 2011, 2012a, 2013a).

American Indian and Alaska Native Cultural Resources

A brief review of the archaeology and ethnography of culture areas within the study area was provided in the 2007 PEIS (USDOI BLM 2007a:3-45 to 3-53). This review covers the Arctic and Subarctic (Alaska), the Northwest Coast, the Southwest, the Great Basin, the Plateau, California, and the Plains Culture Areas. Table 3-9 provides a summary of this information.

European Settlement Resources

The earliest Euro-American contacts with the western U.S. and Alaska, which typically began with exploration or trading, started in the 1500s in the Southwest and California. By the late 1700s and early 1800s much of what is now the western U.S. was being traversed by explorers and fur traders. A summary of these encounters and the European settlement resources present with the seven culture areas is provided in the 2007 PEIS (USDOI BLM 2007a:3-54 to 3-56).

TABLE 3-9
Culture Areas, Prehistoric Occupation Periods, and Selected Common Site Types

Culture Area	Paleoindian	Middle Period or Archaic	Late or Sedentary Period
Arctic and Subarctic	*13,000+ to 9,000 B.P.* Open campsites Cave or rockshelter occupation sites Animal kill and lithic processing sites	*9,000 to 6,000 B.P.* Semi-subterranean houses Open campsites and tent camps	*6,000 to 250 B.P.* Semi-subterranean house villages Open campsites and tent camps
Northwest Coast	*12,500+ to 6,000 B.P.* Open campsites Cave or rockshelter occupation sites		*6,000 to 250 B.P.* Large, cedar plank pithouse villages Fortified sites Seafood capture or processing sites Pictograph and petroglyph sites
California	*11,000(?) to 8,000 B.P.* Open campsites Animal kill or processing sites	*8,000 to 5,000 B.P.* Open campsites and coastal villages Plant or seafood processing sites	*5,000 to 250 B.P.* Large coastal villages Burial mounds Extensive seafood, sea mammal, and plant processing sites Pictograph and petroglyph sites
Great Basin	*11,500+ to 8,000 B.P.* Open campsites Cave occupation sites Lithic processing sites	*8,000 to 4,000 B.P.* Cave or rockshelter occupation sites Pithouse villages Plant and lithic processing sites Fishing sites	*4,000 to 250 B.P.* Cave or rockshelter occupation sites Small pithouse villages Plant and lithic processing sites Storage pits Pictograph and petroglyph sites
Southwest	*11,500 to 8,000 B.P.* Open campsites Animal kill and lithic processing sites Cave occupation sites	*8,000 to 2,000 B.P.* Open campsites Cave or rockshelter occupation sites Pithouses and storage pits Waddle and daub structures Lithic processing sites Pictograph and petroglyph sites	*2,000 to 250 B.P.* Pithouse villages Storage pits Above-ground structures (Pueblos) Below-ground structures (Kivas) Irrigation ditches and roads Navajo hogans and pueblitos Pictograph and petroglyph sites
Plains	*12,000 to 8,000 B.P.* Open campsites Cave or rockshelter occupation sites Animal kill and lithic processing sites	*8,000 to 2,000 B.P.* Open campsites Cave or rockshelter occupation sites Pithouses and storage pits Tipi ring sites Cairns and cairn lines Animal kill, lithic, and plant processing sites	*2,000 to 250 B.P.* Open campsites and tipi ring sites Waddle and daub structures Earthlodge villages Burial mounds Storage pits Cave or rockshelter occupation sites Small pithouse villages Cairns and cairn lines Animal kill, lithic, and plant processing sites Pictograph and petroglyph sites
Plateau	*12,500 to 8,000 B.P.* Open campsites Cave or rockshelter occupation sites Fishing sites Lithic processing sites	*8,000 to 4,000 B.P.* Open campsites Small pithouse villages Cave occupation sites Animal or fish processing sites Lithic processing sites Plant processing sites	*4,000 to 250 B.P.* Pithouse and longhouse villages, often with burials Open campsites Cave occupation sites Storage pits Animal or fish processing sites Lithic and plant processing sites Pictograph and petroglyph sites

Public lands in the West contain cultural resources representing all major periods and events in the broad sweep of Euro-American history. The most common rural manifestations of these dominant themes include transportation resources such as ferry sites, railroads, trails, and roads; military sites (training grounds and battlefields); and mining resources related to exploration (prospect pits), extraction (adits, hydraulic cuts, and quarries), and processing (smelters and mills). Other resources include homesteading, ranching, and farming resources (human and animal shelter and irrigation development); fishery resources (boats, fish traps, and weirs); and logging resources (stumpage, sawmills, and human and animal shelter). Evidence of community development includes rural schools, stores, churches, and community centers. Recreation and leisure sites include cabins, resorts, and trail systems.

Important Plant Uses and Species Used by American Indians and Alaska Natives

Although universally important, plant use by Native American and Alaska Native groups is extremely varied, both by region and by group. Subsistence use of such plant products as roots and tubers, stalks, leaves, berries, and nuts is essential to native people. Vegetation also provides habitat for important wildlife species.

Most Native American and Alaska Native groups constructed a variety of residential shelters and other buildings such as ceremonial lodges and sweat houses, using a combination of materials, usually employing a locally derived hardwood as part of the structural frame. The frames were then covered with other readily available materials, such as planks, mats, and brush. Wood has been burned to cook food, warm dwellings, and facilitate toolmaking. Trees have been fashioned into various types of watercraft and terrestrial hauling devices. Various woods have been carved or used to produce utilitarian implements like bowls and spoons, and also ceremonial items, such as pipes and totems, and many other items of material culture.

The use of plants for medicinal purposes is widespread. Plants such as sweetgrass, cedar, and sage (referring to both *Salvia* and *Artemisia* spp.), have seen important religious and other ceremonial uses. The use of grasses and other plant resources for basket, box, and tool making also can be observed in the cultures of numerous Native American and Alaska Native groups. Plant products also have been used to make textiles, cordage, and matting, as well as to tan hides. The use of plant dyes, paints, and soaps is widespread.

Visual Resources

Public lands have a variety of visual (scenic) values that warrant different levels of management. Visual resources in these landscapes consist of land, water, vegetation, wildlife, and other natural or man-made features visible on public lands. Vast areas of grassland, shrubland, canyonland, and mountain ranges on public lands provide scenic views. Surface-disturbing impacts on public lands have the potential to impact scenic views. Visual Resource Management (VRM) is the BLM's system for protective management of scenic values and minimizing the visual impacts of surface-disturbing activities.

Different levels of scenic values require different levels of management. The VRM system provides a way to identify and evaluate scenic values to determine the appropriate levels of management. The VRM system has two stages: land use planning and land use plan implementation. The land use planning stage involves inventory of scenic values (Visual Resource Inventory [VRI] Classes) and designation of visual management decisions (VRM Classes). The land use plan implementation stage involves visual impact analysis, mitigation to reduce adverse visual impact and determining conformance to the land use plan VRM Class designations.

BLM lands are inventoried for three scenic values: 1) scenic quality, 2) public sensitivity for the scenic quality, and 3) distance zones. VRI Classes are assigned based on systematic procedures that combine the three inventory factors, as outlined in BLM Handbook H-8410-1, *Visual Resource Inventory* (USDOI BLM 1986a). There are four VRI classes, with VRI Class I and II representing areas with the highest visual value and VRI Class IV representing landscapes with lowest visual value. The VRI information is taken into consideration with the other natural and cultural resource values and resource allocations to determine VRM Classes during the land use planning process.

VRM Classes have established management objectives which land use authorizations must meet to be in conformance with the land use plan (USDOI BLM 1986a). VRM classes range from Class I to IV, with Class IV allowing for the most visual change to the existing landscape and Class I allowing for the least (Table 3-10).

TABLE 3-10
Visual Resource Management Classes and Objectives and Appropriate Management Activities

VRM CLASS	Visual Resource Objective	Change Allowed (Relative Level)	Relationship to the Casual Observer
Class I	Preserve the existing character of the landscape. Manage for natural ecological changes.	Very Low	Activities should not be visible and must not attract attention.
Class II	Retain the existing character of the landscape.	Low	Activities may be visible, but should not attract attention.
Class III	Partially retain the existing character of the landscape.	Moderate	Activities may attract attention but should not dominate the view.
Class IV	Provide for management activities which require major modification of the existing character of the landscape.	High	Activities may attract attention, may dominate the view, but are still mitigated.

During the analysis stage, the potential visual impacts from proposed activities or developments are assessed to determine whether the potential visual impacts will meet the management objectives for the area. A visual contrast rating is used, in which the project features are compared with the major features in the existing landscape using the basic design elements of form, line, color, and texture. This process is described in BLM Handbook H-8431-1, *Visual Resource Contrast Rating* (USDOI BLM 1986b). Activities or modifications in a landscape that repeat the basic design elements are thought to be in harmony with their surroundings. Modifications that do not harmonize are said to be in contrast with their surroundings.

Wilderness and Other Special Areas

The BLM manages certain lands that possess unique and important historical, anthropological, ecological, biological, geological, and paleontological features. These features include undisturbed wilderness tracts, critical habitat, natural environments, open spaces, scenic landscapes, historic locations, cultural landmarks, and paleontologically rich regions. Special management is administered with the intent to preserve, protect, and evaluate these significant components of our national heritage. Most special areas are either designated by an Act of Congress or by Presidential Proclamation, or are created under BLM administrative procedures.

The NLCS is the primary management framework for these specially designated lands. Of the nearly 247 million acres administered by the BLM, approximately 27 million acres are managed under the NLCS program. The NLCS designations primarily include National Monuments, National Conservation Areas, Designated Wilderness and WSAs, National Scenic and Historic Trails, and Wild, Scenic, and Recreational Rivers (Map 3-7 and Table 3-11; USDOI BLM 2013a).

Outside of the NLCS framework, the BLM manages other special areas, including Areas of Critical Environmental Concern (ACECs), Research Natural Areas, National Natural Landmarks, National Recreation Trails, and a variety of other area designations. The BLM uses the ACEC designation to highlight public land areas where special management attention is necessary to protect and prevent irreparable damage to important historical, cultural, and scenic values; fish or wildlife resources; or other natural systems or processes. The ACEC designation may also be used to protect human life and safety from natural hazards.

Additional discussion of NLCS lands and ACECs is provided in the 2007 PEIS (USDOI BLM 2007a:3-56 to 3-58). Table 3-11 summarizes current information about these areas on BLM administered lands. A total of 1,024 areas comprising nearly 21 million acres are designated as ACECs; 46 areas comprising more 400,000 acres are designated as National Natural Landmarks; and 192 areas comprising over 500,000 acres are designated as Research Natural Areas. An additional 36 million acres fall under various other designations, such as the Lake Todatonten Special Management Area, the Santa Rosa Mountains National Scenic Area, HMAs, and Globally Important Bird Areas. In addition, more than 3,300 miles of vehicle routes and trails are designated as National Backcountry Byways and National Recreation Trails (USDOI BLM 2012a). The BLM also cooperates with the National Park Service in implementing the National Natural

TABLE 3-11
National Landscape Conservation System and Other Special Designation Areas on Public Lands as of September 2011

State	National Landscape Conservation System Area														Non-NLCS Area	
	Outstanding Natural Areas, Forest Reserve, and Cooperative Management and Protection Areas		National Monuments		National Conservation Areas		Wilderness Areas		Wilderness Study Areas		Wild, Scenic, and Recreational Rivers		National, Historic, and Scenic Trails		Acres of Critical Environmental Concern	
	# of Sites	Acres	# of Sites	Acres	# of Sites	Acres	# of Sites	Acres	# of Sites	Acres	# of Sites	Acres/Miles[1]	# of Sites[2]	Miles	# of Sites	Acres
Alaska	-	-	-	-	1	1,208,624	-	-	1	326,000	6	609,280/952	1	149	52	8,682,156
Arizona			5	1,774,213	3	119,234	47	1,397,106	2	63,930	-	-	3	122	58	774,124
California	2	7,560	3	301,899	1	56,167	86	3,834,292	67	812,566	8	24,800/108	4	612	185	5,320,721
Colorado			1	170,965	3	398,668	5	205,814	54	548,219	-	-	2	86	71	517,785
Idaho			1	274,693	1	470,840	7	517,362	44	655,512	16	313 miles	5	452	102	591,671
Montana			2	375,027	-	-	1	6,347	39	449,963	1	89,300/149	3	358	54	380,795
Nebraska			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nevada			-	-	3	1,045,668	45	2,055,005	63	2,552,457	-	-	3	1,147	51	1,459,704
New Mexico			2	9,379	2	256,207	5	169,523	58	958,751	2	22,720/71	3	348	153	1,023,241
North Dakota			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oklahoma			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oregon	2	496,258	1	55,930	-	-	8	247,993	88	2,653,135	25	255,916/812	3	68	181	810,738
South Dakota			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Texas			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Utah			1	1,866,134	2	108,317	18	260,273	86	3,234,465	11	20 miles	3	583	59	764,782
Washington			-	-	-	-	1	7,140	1	5,636	-	-	1	12	15	19,378
Wyoming			-	-	-	-	-	-	42	574,401	-	-	6	1,816	42	571,626
Total	4	503,818	16	4,828,240	16	3,663,725	223	8,700,855	545	12,835,035	69	1,002,016/2,425	16	5,753	1,023	20,916,721

[1] Only miles (no acreages) are given for wild, scenic, and recreational rivers designated after 2000.
[2] Figures in the number column do not add up to the total shown at the bottom areas may cross state lines and are reported in the count for each state.
Sources: USDOI BLM 2012a, 2013f.

Landmark Program as it applies to public lands. The National Park Service, through the National Natural Landmark Program, designates significant examples of the Nation's ecological and geological heritage.

Recreation

Public lands provide visitors with a wide range of recreational opportunities, including hunting, fishing, camping, hiking, dog mushing, cross-country skiing, boating, hang gliding, OHV driving, mountain biking, birding, viewing scenery, and visiting natural and cultural heritage sites. In addition to the recreational opportunities afforded the public by wilderness and other special areas discussed earlier, the BLM administers more than 3,650 recreation sites and 380 Special Recreation Management Areas (SRMAs), 9,000 miles of floatable/boatable rivers and lakes, 54 National Back Country Byways, 5,750 miles of National Scenic, Historic, and Recreational Trails, and thousands of miles of multiple use trails used by motorcyclists, hikers, equestrians, and mountain bikers (USDOI BLM 2012b, d).

The BLM's long-term goal is to provide opportunities to the public for environmentally responsible recreation. Over 4,000 communities with a combined population of 40 million people are located within 25 miles of public lands, and more than 100 million acres of public lands are located within a day's drive of a major urban area (USDOI BLM 2012b).

In 2010, the America's Great Outdoors initiative, a presidential conservation and recreation agenda, was launched. This initiative has increased awareness of, and expanded opportunities for, recreational opportunities on BLM-administered lands.

BLM field offices reported 57.8 million recreational visits to BLM public lands and waters in FY 2011, a decrease of 1 percent from the previous year. The total amount of time spent on public lands, reported as visitor days, was estimated at 67 million visitor days, an increase of less than 1 percent from the previous year (Table 3-12; USDOI BLM 2012a). The greatest number of visitor days occurred in Arizona and California. Overall, developed recreational sites were used about as frequently as non-developed dispersed areas. Recreational use of public lands consists predominately of camping and picnicking, which represented 42 percent of all visitor days in 2011. Other important recreational activities include off-highway travel (12 percent); non-motorized travel, such as hiking, horseback riding, and mountain biking (10 percent); hunting (8 percent); and viewing public land resources and interpretation and education (7 percent). The remaining visitor days were associated with driving for pleasure, special events, sports and activities, power and non-power boating, fishing, and swimming. Snow- and ice-based activities, such as cross-country skiing, snowmobiling, and snowshoeing, represented less than 1 percent of visitor days (USDOI BLM 2012a).

Commercial revenues generated by recreation on BLM lands are discussed in the Social and Economic Values section of this chapter.

TABLE 3-12
Estimated Recreation Use of Public Lands During Fiscal Year 2011

State	Number of Visitor Days[1] (thousands)		
	Recreation Sites	Dispersed Areas	Total[2]
Alaska	196	434	630
Arizona	9,187	1,540	14,554
California	11,523	3,907	15,486
Colorado	1,549	5,083	6,757
Idaho	1,337	3,177	4,542
Montana, North Dakota, and South Dakota	1,081	2,965	4,046
Nevada	1,917	3,225	5,379
New Mexico, Oklahoma, and Texas	457	1,139	1,605
Oregon and Washington	3,387	3,853	7,411
Utah	1,835	2,939	4,822
Wyoming and Nebraska	674	1,003	1,697
Total	33,148	29,267	66,950

[1] One visitor day equals 12 visitor hours.
[2] Includes visitor days for recreation lease sites and recreation partnership sites.
Note: columns may not add up to totals due to rounding.
Source: BLM Public Land Statistics (USDOI BLM 2012a).

Rights-of-way, Facilities, and Roads

Rights-of-way

Under FLPMA and the Mineral Leasing Act provisions, the BLM issues ROW grants to authorize the construction, operation, and maintenance of a wide range of projects on public lands. These include

petroleum pipelines, electrical transmission lines, telecommunications lines, energy development and distribution facilities, water facilities, communication sites, and roads. Rights-of-way are issued for a specific term for the use of public lands. In FY 2011, there were nearly 104,000 ROWs on public lands, and the BLM issued nearly 2,700 new grants (USDOI BLM 2012a).

The length and width of an ROW (and the resulting acreage of public lands) is dependent on a variety of physical and operational factors, including topography, geology, safety, type of use or uses proposed within the ROW, current technology, and access needs. Rights-of-way may also be subject to controls or limitations prescribed by law or identified in BLM land use plans. The BLM encourages the utilization of ROWs in common, where practical, in order to minimize adverse environmental impacts. Land use plans identify ROW corridors for existing and future ROW development.

Vegetation can interfere with ROW site access, facility maintenance, and electric power flow, and pose safety problems for workers and other ROW users. Therefore, ROW grants generally include provisions that authorize the holder to manage vegetation within and adjacent to the ROW using methods approved by the BLM. The scope and intensity of vegetation treatments within ROWs are operationally specific and highly variable. Inspections are conducted periodically to assess vegetation management needs within ROWs. Pre-emergence or post-emergence herbicides can be applied to prevent or control young emerging and existing vegetation. Other types of vegetation treatments may also be utilized.

Invasive plant species may be associated with the open conditions along ROWs. Additionally, vegetation removal activities can result in ground disturbance that facilitates the establishment and spread of these species. The relatively open nature of ROWs makes them attractive to many recreationists, which can facilitate the spread of invasive plants that are present on ROWs.

Facilities and Roads

The BLM operates or oversees operations on numerous facilities on public lands. These include oil, gas, geothermal, and mineral exploration and production sites; numerous campgrounds, 65 interpretive centers, and other recreational facilities; nearly 5,000 buildings and 655 administrative sites; more than 72,000 miles of roads; and communication facilities (USDOI BLM 2012a).

Construction and operations disturbance can often introduce noxious weeds and other invasive vegetation to facility sites and roads. In general, vegetation management at facilities focuses on controlling vegetation that can pose a safety or fire hazard, or is not aesthetically pleasing. In such situations the vegetation is managed using several methods, which can be integrated into an effective management process. Residual herbicides, applied to vegetation before or after emergence, offer extended management in areas where bare ground is required for safety purposes. Mechanical methods, such as mowing, and manual control by hand pulling have been used to manage vegetation along roads, as well as in sensitive areas.

Social and Economic Values

Social/Demographic Environment

The western U.S., including Alaska, is more sparsely populated than the rest of the U.S., containing about 33 percent of the total U.S. population, but comprising approximately 65 percent of the total land area. In 2010, over 102 million people lived in this region, with over 60 million in California and Texas, alone (Table 3-13). Population density is relatively low, averaging about 46 people per square mile (mi^2), which is just over half of the national average of nearly 87 people per mi^2. Density ranges from about 1 person per mi^2 in Alaska to over 239 persons per mi^2 in California. Based on 2010 census data, population growth in western U.S. between 2000 and 2010 was 13.8 percent, which was higher than the national average of approximately 10 percent (U.S. Department of Commerce Bureau of the Census 2011). Many of the western states exceeded the national average, with growth rates of 20 percent or higher during this time period. States with the greatest rate of population growth were Nevada (35.1 percent), followed by Arizona (24.6 percent), Utah (23.8 percent) and Idaho (21.1 percent). Population growth was highest in metropolitan areas. Population growth in the western U.S. has slowed from the rate of increase observed during the previous decade.

The age distribution of the population of the western U.S. is similar to the nationwide distribution. Approximately 25 percent of the population is under 18 years of age, while about 12 percent is over 65. Alaska and Utah are slight exceptions, with a higher percentage of people under 18 (26 percent and 32 percent, respectively) and a lower percentage of people over 65 (8 percent and 9 percent, respectively).

TABLE 3-13
Population, Age Distribution, and Race in the Western States and Alaska

State	Population 2010 (thousands)	Percent Change from 2000	Density (per mi^2)	Age Distribution		Percent of Hispanic Origin	Percent of Both Hispanic and Non-Hispanic Origin					
				Percent Under 18	Percent Over 65		Caucasian	African American	American Indian	Asian/Pacific Islander	Other	More than 1 Race
Alaska	710	13.3	1.2	26.4	7.7	5.5	66.7	3.3	14.8	6.4	1.6	7.3
Arizona	6,392	24.6	56.3	25.5	13.8	29.6	73.0	4.1	4.6	3.0	11.9	3.4
California	37,254	10.0	239.1	25.0	11.4	37.6	57.6	6.2	1.0	13.4	17.0	4.9
Colorado	5,029	16.9	48.5	24.4	10.9	20.7	81.3	4.0	1.1	2.9	7.2	3.4
Idaho	1,568	21.1	19.0	27.4	12.4	11.2	89.1	0.6	1.4	1.4	5.1	2.5
Montana	989	9.7	6.8	22.6	14.8	2.9	89.4	0.4	6.3	0.7	0.6	2.5
Nebraska	1,826	6.7	23.8	25.1	13.5	9.2	86.1	4.5	1.0	1.8	4.3	2.2
Nevada	2,701	35.1	24.6	24.6	12.0	26.5	66.1	8.1	1.2	7.9	12.0	4.7
New Mexico	2,059	13.2	17.0	25.2	13.2	46.3	68.4	2.1	9.4	1.5	15.0	3.7
North Dakota	673	4.7	9.7	22.3	14.5	2.0	90.0	1.2	5.4	1.1	0.5	1.8
Oklahoma	3,751	8.7	54.7	24.8	13.5	8.9	72.2	7.4	8.6	1.9	4.1	5.9
Oregon	3,831	12.0	39.9	22.6	13.9	11.7	83.6	1.8	1.4	4.0	5.3	3.8
South Dakota	814	7.9	10.7	24.9	14.3	2.7	85.9	1.3	8.8	1.0	0.9	2.1
Texas	25,146	20.6	96.3	27.3	10.3	37.6	70.4	11.8	0.7	3.9	10.5	2.7
Utah	2,764	23.8	33.6	31.5	9.0	13.0	86.1	1.1	1.2	2.9	6.0	2.7
Washington	6,725	14.1	101.2	23.5	12.3	11.2	77.3	3.6	1.5	7.8	5.2	4.7
Wyoming	564	14.1	5.8	24.0	12.4	8.9	90.7	0.8	2.4	0.9	3.0	2.2
United States	308,746	9.7	87.4	24.0	13.0	16.3	72.4	12.6	0.9	5.0	6.2	2.9
Western States	102,795	15.0	46.4	25.5	11.6	29.6	68.8	6.6	1.9	7.3	11.5	3.9
Western States as a Percentage of Total U.S.	33.3	-	-	35.4	29.6	60.4	31.6	17.4	66.6	49.4	61.7	44.8

Source: U.S. Department of Commerce Bureau of the Census 2011.

Economic Environment

Employment

Between 2007 and 2012, employment fell by 2 percent in the 17 western U.S., which was slightly lower than the national decline of 3 percent. States with positive employment growth during this period include Alaska, Nebraska, North Dakota, Oklahoma, South Dakota, Texas, and Wyoming. States with the most employment growth were North Dakota (18 percent), Alaska (5.6 percent), and Texas (5.1 percent). States with above average decreases in employment include Nevada (-12.3 percent), Arizona (-8.8 percent), Idaho (-6.8 percent), California (-5.9 percent), Oregon (-4.3 percent), and New Mexico (-3.1 percent; U.S. Department of Labor Bureau of Labor Statistics 2013a).

In 2013, the average annual nationwide unemployment rate was 7.4 percent (Table 3-14). Unemployment rates in the western U.S. were less than the national average, with the greatest unemployment in Nevada (9.8 percent), California (8.9 percent), Arizona (8.0 percent), and Oregon (7.7 percent). The unemployment rate was lowest in North Dakota (2.9 percent), South Dakota (3.8 percent), and Nebraska (3.9 percent; U.S. Department of Labor Bureau of Labor Statistics 2014). Unemployment rates were generally higher for African Americans and Hispanics than other races.

Over 33 percent of the nation's employment opportunities, amounting to more than 58 million jobs, are located in the western U.S. (Table 3-15). Employment in the trade and services industries accounts for over half of the total jobs. Industries related to natural resources, such as agriculture and mining, are important sources of employment and represent nearly half of the nation's agricultural services, forestry, and fishing jobs. Employment in the government and military sector is higher in Alaska than in other states, accounting for 24 percent of total jobs versus about 14 percent overall in the western U.S.

Income

Based on data from 2008 to 2012, the per capita income in the western U.S. is $28,575, which is similar to the national average of $28,051. Per capita income is greatest in Alaska, Colorado, and Washington, and lowest in Utah, Idaho, and New Mexico (U.S. Department of Commerce Bureau of the Census 2014).

TABLE 3-14
Percent Unemployment for the Western U.S. and Alaska

State	Year			
	1990	2000	2010	2013
Alaska	7.0	6.6	8.0	6.5
Arizona	5.5	3.9	10.4	8.0
California	5.8	4.9	12.4	8.9
Colorado	5.0	2.7	9.0	6.8
Idaho	5.9	4.9	8.7	6.2
Montana	6.0	4.9	6.7	5.6
Nebraska	2.2	3.0	4.7	3.9
Nevada	4.9	4.1	13.8	9.8
New Mexico	6.5	4.9	8.0	6.9
North Dakota	4.0	3.0	3.8	2.9
Oklahoma	5.7	3.1	6.9	5.4
Oregon	5.6	4.9	10.8	7.7
South Dakota	3.9	2.3	5.1	3.8
Texas	6.3	4.2	8.2	6.3
Utah	4.3	3.2	8.1	4.4
Washington	4.9	5.2	9.9	7.0
Wyoming	5.5	3.9	7.0	4.6
United States	5.6	4.0	9.6	7.4

Source: U.S. Department of Labor Bureau of Labor Statistics 2014.

In 2011, the median household income in the western U.S. was $52,376, a 4.1 percent decrease from the previous year. The highest median annual income in the western U.S. was paid to individuals employed by the information ($60,379) sector, followed by public administration ($58,072), and professional services ($54,196) sectors. The lowest median annual income was earned by those working in agriculture, forestry, fishing, and hunting ($27,243); portions of the service industry (e.g., arts, entertainment, recreation, and accommodation and food services [$27,877]); and retail trade ($34,057; U.S. Department of Labor Bureau of Labor Statistics 2013a).

Environmental Justice

Executive Order 12898 directs federal agencies to address the disproportionately high and adverse human health or environmental effects of their actions on minority and low-income populations. Minority populations are defined as Hispanics, Asian Americans and Pacific Islanders, African-Americans, American Indians, and Alaska Natives. Low income populations are defined as those below the poverty level, which is established by the U.S. Census Bureau. Information on minority and low income populations can be obtained

TABLE 3-15
Percent Unemployment by Industry in 2011

State	Agriculture	Mining and Natural Resources	Construction	Manufacturing	Transportation and Public Utilities	Trade (Wholesale and Retail)	Finance, Insurance, and Real Estate	Information	Services	Government	Total Number (thousands)
Alaska	0.2	6.8	5.2	3.5	5.5	11.3	6.3	1.6	35.6	24.0	454
Arizona	0.8	1.1	4.9	5.0	3.2	14.4	12.4	1.5	43.0	13.6	3,228
California	1.1	1.5	4.3	6.7	3.2	13.3	10.3	2.6	44.0	13.1	19,969
Colorado	1.4	2.1	5.7	4.5	2.8	12.7	11.9	2.6	42.1	14.2	3,200
Idaho	4.4	1.9	5.9	6.8	3.2	14.5	9.4	1.4	38.2	14.4	879
Montana	4.7	3.0	6.4	3.2	3.4	14.0	9.0	1.4	39.5	15.3	629
Nebraska	4.2	1.1	5.1	7.8	5.1	14.1	9.7	1.6	37.2	14.2	1,231
Nevada	0.3	1.4	4.6	2.8	4.0	12.8	12.1	1.2	49.7	11.1	1,498
New Mexico	2.5	3.4	5.6	3.3	2.7	12.9	7.1	1.5	40.9	20.1	1,066
North Dakota	6.1	4.5	6.3	4.7	4.5	15.0	8.1	1.5	33.2	16.0	527
Oklahoma	4.0	6.0	5.4	6.4	3.2	12.8	7.9	1.3	35.8	17.2	2,168
Oregon	3.1	1.5	4.7	8.2	3.0	14.0	8.9	1.8	41.5	13.3	2,222
South Dakota	5.7	1.3	5.7	7.3	3.1	14.9	10.2	1.3	35.5	15.1	564
Texas	1.8	3.5	6.2	6.1	4.0	13.7	10.0	1.6	39.5	13.6	14,611
Utah	1.1	1.2	5.5	7.3	3.5	13.6	12.7	2.1	38.7	14.3	1,658
Washington	2.1	1.2	5.0	7.5	3.0	13.6	8.9	3.0	39.3	16.3	3,829
Wyoming	3.3	9.4	7.5	2.8	4.4	12.2	9.0	1.2	31.1	19.1	391
Western U.S.	1.8	2.3	5.2	6.2	3.5	13.5	10.1	2.1	41.3	14.0	58,125

Source: U.S. Department of Commerce Bureau of Economic Analysis 2012.

from Census data and then compared to an appropriate statistical reference area.

Given the programmatic nature of this PEIS, it is not feasible to do an analysis of minority and low-income populations based on the complete coverage of BLM-administered lands. These analyses will be done at the local level for individual treatment programs. Instead, general information for the states covered by this PEIS is provided.

Information on minority populations is provided in Table 3-13. The western U.S. contains a large percentage of the nation's minority populations, including more than 60 percent of the nation's Hispanics and American Indians, and nearly 50 percent of the nation's Asian/Pacific Islanders. In particular, Arizona, California, Nevada, New Mexico, and Texas contain large Hispanic populations, which comprise from 25 to over 45 percent of the total population in each of these states. Almost 15 percent of Alaska's population is comprised of American Indians.

The population of the western U.S. living below the poverty level is estimated at 14.8 percent, which is consistent with the national average (U.S. Department of Commerce Bureau of the Census 2014). Table 3-16 presents the percent of people below the poverty level, by state, as compared to the U.S. as a whole. The highest poverty rates occur in New Mexico, Texas, and Arizona, while the lowest rates occur in Alaska and Wyoming. However, within each state, areas of high poverty may vary geographically, and could include some rural areas where BLM-administered lands are prevalent.

Revenues Generated by BLM Lands

The BLM allows land use for authorized private commercial activities such as energy and mineral commodity extraction, timber harvesting, livestock grazing, recreation, and the development of ROWs on public land. Tax revenues generated by public land is used to assist state and local governments, support the General Fund of the U.S. Treasury, and offset charges for program operations where certain fees collected can be retained by the BLM. During FY 2011, the BLM collected nearly $245 million from a variety of land uses in the western U.S. (Table 3-17; USDOI BLM

2012a). Additionally, royalties collected by the Office of Natural Resources Revenue from leasable minerals produced from federal lands and managed by the BLM are greater than $4 billion annually. Operating revenues from mineral leases and permits totaled $11.2 million in FY 2011 (USDOI BLM 2012a). These receipts include rental collections from oil and gas ROWs, revenues from developed lands within the Naval Oil Shale Reserve in Colorado, lease rentals and bonus bids from the National Petroleum Reserve in Alaska, and fees related to mining claims, holding fees, and non-operating revenues.

TABLE 3-16
Percent of People Below the Poverty Level for the Western U.S. and Alaska

State	Percent Below Poverty Level
Alaska	9.6
Arizona	17.2
California	15.3
Colorado	12.9
Idaho	15.1
Montana	14.8
Nebraska	12.4
Nevada	14.2
New Mexico	19.5
North Dakota	12.1
Oklahoma	16.6
Oregon	15.5
South Dakota	13.8
Texas	17.4
Utah	12.1
Washington	12.9
Wyoming	11.0
Western Region	14.8
United States	14.9

Source: U.S. Department of Commerce Bureau of the Census 2014 (2008 to 2012 data).

Woodland products are an important commodity and source of revenue generated on public lands. These products include timber; other wood products, such as fuelwood, posts, and poles; and non-wood forest products, such as Christmas trees, cactus, seed, yucca, pinyon nuts, mushrooms, and yew bark. During FY 2006 to 2011, an average of approximately $28 million was received annually from woodland products harvested from public lands, the majority of which came from timber sales. The average volume of timber harvested annually between 2006 and 2011 was approximately 20 million cubic feet. The revenue generated from timber sales has generally decreased, from $46.7 million in 1997 to $19.4 million in 2011 (USDOI BLM 2007e, 2008b, 2009b, 2010a, 2011, 2012a, 2013a).

Over ninety percent of income from the sale of timber and other vegetative materials is derived from Oregon and California and Coos Bay (Oregon) Wagon Road Grant Lands. Timber sales on other public lands include sales from salvage timber and forest health projects.

Grazing fees are derived using a formula established in the *Public Rangelands Improvement Act of 1978*, which is based on several index factors, including private land lease rates, beef cattle prices, and the cost of production. In 2012, the fee was $1.35 per AUM, which is the same as the fee in 2011 (USDOI BLM 2012b). Approximately $12.9 million was collected in grazing receipts in FY 2011 (USDOI BLM 2012a). Half of the grazing fees are used by the BLM for rangeland improvements (USDOI BLM 2012b).

Fees are charged at many public recreation sites to provide for maintenance and improvement, and include access fees for Entrance Permits, Special Area Permits, Daily Use Permits, Commercial, Competitive, and Group Permits, Leases, and Passports. At other locations, generally those without public facilities, no fees are charged. In FY 2011, 90 percent of recreational use on public lands, in terms of visitor days, occurred in non-fee areas (USDOI BLM 2012a). The BLM also issues special recreation permits to qualified commercial companies and organized groups such as outfitters, guides, vendors, and commercial competitive event organizers who conduct activities on both fee and non-fee lands. Nearly $17.4 million were collected in recreation fees in FY 2011 (USDOI BLM 2012a).

In FY 2011, sales of public land and material, including receipts from the sale of public land, and the sale of vegetative and mineral materials, totaled nearly $20.8 million, of which $6.8 million were from the sale of certain public lands in Clark County, Nevada, near the city of Las Vegas, under the Southern Nevada Public Land Management Act (USDOI BLM 2012a).

In addition to providing revenue for the BLM, all of the major public land resource use categories generate economic activity in the communities and states in which they occur. For example, there are nearly 17,700 grazing permits/leases in force on public lands, supporting nearly 12.4 million AUMs (Table 3-6). Alaska and Texas have no grazing permits/leases in force. The value of these grazing permits/leases and the

TABLE 3-17
Revenues Generated from Public Lands by Source for Fiscal Year 2011

State	Mineral Leases	Timber Sales	Land and Material Sales	Grazing Fees	Recreation Fees	Other[1]	Total
Alaska	$177,048	$0	$147,412	$0	$297,636	$244,200	$866,296
Arizona	164,145	30	1,148,015	590,660	1,558,148	5,174,916	8,635,913
California	1,150,461	375,327	1,519,999	236,116	3,919,741	15,463,819	22,665,463
Colorado	1,150,587	18,324	544,930	546,467	525,830	1,197,756	3,983,894
Idaho	48,153	669,386	437,872	1,427,646	905,063	2,012,714	5,501,134
Montana	2,275,206	573,232	122,619	1,774,829	392,321	231,322	5,369,529[2]
Nebraska	0	0	0	1,665	0	0	1,665
Nevada	-174,777	26,581	9,702,808	1,937,754	3,874,883	8,515,169	23,882,418
New Mexico	2,640,656	53,824	3,815,706	2,064,872	422,656	2,369,195	11,366,909[2]
North Dakota	3,397	0	712	14,353	0	4,125	22,587
Oklahoma	0	0	0	128	0	0	128
Oregon	53,499	16,959,414	297,646	1,107,627	2,441,837	1,975,359	22,835,382[3]
South Dakota	0	7,753	744	160,483	0	3,500	172,480
Texas	0	0	0	0	0	0	0
Utah	1,392,958	15,714	1,234,071	1,060,156	2,863,376	3,474,791	10,041,066
Washington	0	607,096	82,390	44,903	0	31,261	765,650
Wyoming	2,301,344	90,506	1,688,388	1,961,661	168,434	3,693,095	9,903,428
Multiple[4]	118,559,009[5]	0	0	0	0	0	118,559,009
Total	129,741,686	19,397,187	20,743,312	12,929,620	17,369,925	44,391,221	244,647,141

[1] Includes fees and commissions, ROW rents, rent of land, and other sources.
[2] Includes Land Utilization Project land purchased by the federal government under Title III of the Bankhead-Jones Farm Tenant Act and subsequently transferred to the USDOI.
[3] Includes Oregon and California receipts, Coos Bay Wagon Road receipts, and receipts from public domain sales and other categories.
[4] These revenues are not broken down by state in the *Public Land Statistics*.
[5] Includes mining claim and holding fees, application for permit to drill fees, and non-operating revenue. These revenues are not reported by state.
Source: BLM Public Land Statistics (USDOI BLM 2012a).

acreage they entail vary widely depending on the location, soil characteristics, and precipitation. The availability of public land grazing leases is highly beneficial, if not crucial, to some ranching operations, however, and consequently is very important to many rural communities throughout the West.

Similarly, mineral development is an economic mainstay of many western communities. Table 3-15 illustrates the relative importance to the employment base of mineral extraction, particularly in Alaska, North Dakota, Oklahoma, and Wyoming. Each of these states has a much higher percentage of employment in mining/natural resource industry than the average for the West as a whole. This industry sector includes oil and gas, coal, aggregates, and hard rock minerals such as gold and copper. Alaska's oil industry not only supports ongoing employment, but also contributes toward minimizing taxes for all state residents and has provided a substantial cash rebate to residents over the years.

The BLM estimates the contribution to local economies from recreation on public lands. These estimates serve as one example of the economic activity that depends on the public land base. Recreational activity provides revenue for local economies through expenditures associated with activities such as hunting, fishing, and wildlife viewing (Table 3-18). In FY 2012, an estimated $31 million was injected into local economies through these recreation-associated expenditures (USDOI BLM 2013a). These activities produce indirect economic benefits to community businesses providing food, lodging, equipment sales, transportation, and other services. State fish and wildlife management agencies also benefit from spending associated with these activities from sources such as state tax revenue and state administered fishing and hunting license programs.

Expenditures by the BLM

The budget for the BLM was $1.1 billion in FY 2014, and is projected to be $1.1 billion in FY 2015 (USDOI

TABLE 3-18
Estimated Benefits to Local Economies by Recreation on Public Lands in Fiscal Year 2011

State[1]	Fishing Expenditures	Hunting Expenditures	Wildlife Viewing Expenditures	Total
Alaska	$578,759,000	$140,125,000	$650,777,000	$1,369,661,000
Arizona	898,694,000	361,468,000	938,904,000	2,198,766,000
California	2,710,963,000	910,828,000	4,681,133,000	8,302,924,000
Colorado	608,089,000	497,348,000	1,554,265,000	2,659,702,000
Idaho	316,929,000	290,884,000	297,226,000	905,039,000
Montana	253,511,000	347,805,000	421,625,000	1,022,941,000
Nevada	161,990,000	144,570,000	405,696,000	712,256,000
New Mexico	337,233,000	184,025,000	332,835,000	854,093,000
North Dakota	93,729,000	129,114,000	22,913,000	245,576,000
Oregon	556,574,000	418,447,000	869,584,000	1,844,605,000
South Dakota	131,089,000	185,258,000	183,204,000	499,551,000
Utah	415,617,000	306,636,000	632,176,000	1,354,429,000
Washington	904,796,000	313,134,000	1,502,311,000	2,720,241,000
Wyoming	584,056,000	153,737,000	442,253,000	1,180,046,000
Total	8,552,029,000	4,383,379,000	12,934,905,000	25,870,313,000

[1]Estimates include only states with more than 50,000 acres of public lands. No estimates were made for Nebraska, Oklahoma, or Texas.
Source: BLM Public Lands Statistics (USDOI BLM 2012a).
Note: Columns may not add up to totals due to rounding.

BLM 2014b). In FY 2012, $960 million was allocated to management of lands and resources (Table 3-19). These expenditures included integrated management of public land, renewable and cultural resources, fish and wildlife, threatened and endangered species, recreation, and energy and minerals.

Wildland Fire Management

While the amount budgeted for wildland fire management may be relatively consistent from year to year, the cost of fighting fires has varied substantially. Since 2009, the BLM's fuels management budget has averaged between $60 million and $100 million annually. The total wildland fire management budget for the BLM ranges from $250 million to $280 million annually.

Table 3-20 shows the BLM's fire suppression expenditures for recent years. The variability often results from changing weather, but terrain, vegetation, and proximity to populated areas all contribute to the cost of fighting a fire.

The cost of fire suppression also depends on the number and size of fires. Approximately 95 percent of wildland fires are controlled in the initial attack, when they are relatively small and not yet seriously out of control. Table 3-21 illustrates the total acreage of USDOI-managed lands burned by unwanted fires in recent years. Between 2008 and 2012, the acreage burned by fires has varied, with the lowest burned area in 2009 and the highest in 2012.

Hazardous Fuels Reduction

Reducing the hazardous fuels available to sustain a wildland fire can be costly. The USDOI treated 733,871 acres in the wildland-urban interface (WUI) during 2012 at an average cost of $224 per acre. Treatment can cost up to $5,000 per acre for labor-intensive, small, mechanical treatments in forested WUI areas. During the same year, the USDOI treated 266,619 acres in non-WUI areas at a cost of about $69 per acre (USDOI 2014).

Weed Management

Herbicides and other vegetation management methods are employed to control invasive plant species, which have caused a variety of problems on public lands. The Vegetation section of this chapter addresses several major types of weed infestations on public lands. As Duncan and Clark (2005) noted, "The economic impact of most (weed) species is poorly documented. This is generally due to the lack of quantitative information on ecosystem impacts and the challenge of assessing non-market cost such as those to society and the environment (e.g., changes in fire frequency, wildlife habitat, aesthetics, loss of biodiversity)."

TABLE 3-19
Summary of BLM Jobs and Expenditures for the Management of the Lands and Resources Program by Activity and Subactivity (dollars in thousands)

Activity/Subactivity	2013 (Actual)		2014 (Enacted)	
	FTE[1]	Amount	FTE[1]	Amount
Management of Lands and Resources	5,994	$902,160	6,078	$956,875
Land Resources	1,417	231,587	1,493	245,474
Soil, Water, Air	227	41,455	227	42,939
Range Management	670	75,955	675	79,000
Forest Management	48	5,889	81	9,838
Riparian Management	171	21,321	169	21,321
Cultural Resources	116	15,131	114	15,131
Wild Horse and Burros	185	71,836	173	77,245
Wildlife and Fisheries	319	61,136	311	64,868
Wildlife Management	232	48,606	225	52,338
Fisheries Management	87	12,530	86	12,530
Threatened and Endangered Species	154	20,326	159	21,458
Recreation	531	63,429	541	66,961
Wilderness Management	151	17,300	155	18,264
Recreation Resource Management	380	46,129	386	48,697
Resource Protection and Maintenance	532	94,749	524	94,749
Energy and Minerals	1,157	110,092	1,261	130,119
Realty and Ownership	512	62,226	484	67,658
Transportation and Facilities Maintenance	341	65,632	335	65,632
Workforce and Organizational Support	442	160,661	434	165,724
National Landscape and Conservation System	244	29,909	253	31,819
Other[2]	345	41,988	337	44,109

[1] Full Time Equivalent.
[2] Includes Communications Site Management, Mining Law Administration, and Challenge Cost Share.
Source: USDOI BLM 2014b.

TABLE 3-20
BLM and USDOI Fire Suppression Expenditures Fiscal Year 2007 through Fiscal Year 2013

Fiscal Year	Total Expenditure BLM	Total Expenditure USDOI
2007	301,114,240	470,491,000
2008	251,381,120	392,783,000
2009	139,787,520	218,418,000
2010	147,976,960	231,214,000
2011	204,024,320	318,788,000
2012	298,132,480	465,832,000
2013	255,487,360	399,199,000
10-year Annual Average	223,749,184	349,608,100

NA = Not applicable.
Source: USDOI BLM 2014c.

TABLE 3-21
USDOI Unwanted Wildland Fires During 2006 to 2012

Calendar Year	Number of Fires	Total Acreage
2006	11,823	2,554,304
2007	8,212	2,896,507
2008	5,778	2,387,484
2009	6,225	511,790
2010	5,786	1,294,546
2011	7,615	1,423,895
2012[1]	9,151	3,186,827
Total	54,590	14,255,353

[1] 2012 values are estimated.
Source: USDOI 2014.

Expenditures for herbicides used on BLM land are a relatively small part of the agency's budget. Table 3-22 provides information about the estimated cost per acre for currently approved herbicides. These estimates include only the cost of the chemicals; labor and equipment costs for herbicide application are in addition to the costs shown. The BLM estimated it spent $12.7 million to treat weeds on approximately 204,000 acres ($62 per acre) during FY 2012 (Ramos 2014). These costs included herbicide, labor, and equipment costs. The cost of herbicides can vary dramatically, depending on the type selected and the method of application. Costs can also vary significantly by geographic region, vendor, type of chemical (generic versus branded), and size and terrain of the application target area. The BLM's range of estimated application costs for ground applications is typically $45 to $450 per acre for backpack sprayer applications, $35 to $450 per acre for ATV/UTV applications, and $25 to $120 per acre for boom sprayer applications. Costs for aerial applications are estimated at $6 to $40 per acre for fixed-wing aircraft and $15 to $300 per acre for helicopter applications. Occasionally, costs can exceed these ranges, depending on the site conditions. Backpack sprayer applications have been reported as high as $4,200 per acre, and ATV/UTV applications have been reported as high as $800 per acre.

Some herbicide treatments may require reseeding or some other form of site restoration or rehabilitation following herbicide application, particularly large-scale treatments that clear an area of vegetation. The cost of reseeding a site following a treatment varies depending on the extent of work required, and can range anywhere from $350 to $1,000 per acre (USDOI BLM 2014d).

Payments to State and Local Governments

Where the federal government maintains public land, it makes payments to state and local governments for a variety of purposes. Receipts from coal leases and bonus payments, for example, are shared. Payments in lieu of taxes help address the loss of potential local tax income that could have been generated from those public lands if they were in private ownership. Payments in lieu of taxes, as well as other forms of transfer payments, are generally set by law and provided according to a formula. Payments in lieu of taxes, for example, are computed based on the number of acres of public lands within each county and multiplied by a dollar amount per acre. Over $6 billion in payments have been made since 1976. Table 3-23 shows the BLM payments to states and local governments for FY 2011. Note that this table does not include royalty payments associated with leasable minerals that are returned to the state of origin, which exceeded $2 billion in FY2012.

Human Health and Safety

Background Health Risks

This section discusses background information on human health risks of injuries, and cancer and other diseases for people living in the states in which the BLM is planning to implement herbicide treatments. People living in these states are exposed to a variety of risks common to the U.S. as a whole, including automobile accidents and other injuries; contaminants in the air, water, soil, and food; and various diseases. Risks to workers may differ from those facing the general public, depending on the nature of a person's work. Some of these risks may be quantified, but a lack of data allows for only a qualitative description of certain risks. Where data are only available for the U.S. as a whole, it is assumed that these data apply to the treatment states. Information for this section was obtained from the Centers for Disease Control and Prevention (CDC), the National Center for Injury Prevention and Control, the National Center for Health Statistics (NCHS), the National Institute for Occupational Safety and Health (NIOSH), and the Bureau of Labor Statistics.

Risks from Diseases

Disease Incidence

Despite the difficulties in establishing correlations between work conditions and disease, certain illnesses have been linked to occupational hazards. For example, asbestosis and lung cancer among insulation and shipyard workers has been linked to their exposure to asbestos (NIOSH 2012). Pneumoconiosis among coal miners has been correlated with the inhalation of coal dust. Occupational exposures to some metals, dusts, and trace elements, as well as CO, carbon disulfide, halogenated hydrocarbons, nitroglycerin, and nitrates, can result in increased incidence of cardiovascular disease. Neurotoxic disorders can arise from exposure to a wide range of chemicals, including some pesticides. Dermatological conditions like contact dermatitis, infection, trauma, cancer, vitiligo, uticaria, and chloracne have a high occurrence in the agricultural, forestry, and fishing industries.

TABLE 3-22
Herbicide Uses and Costs for Vegetation Treatments on Public Lands During 2011

Herbicide	Type of Application	Acres Treated[1]	Total Herbicide Expenditure[2]	Cost per Acre for Herbicide[2]
2,4-D	Aerial	1,571	$5,216	$3.32
	Ground	37,380	223,161	5.97
Bromacil	Aerial	0	0	NA
	Ground	6,338	728,836	115.00
Chlorsulfuron	Aerial	3,779	25,508	6.75
	Ground	5,347	64,158	12.00
Clopyralid	Aerial	52,789	831,427	15.75
	Ground	2,104	34,463	16.38
Dicamba	Aerial	128	1,440	11.25
	Ground	11,044	141,691	12.83
Dicamba + Diflufenzopyr	Aerial	0	0	NA
	Ground	38	16	0.41
Diquat	Aerial	0	0	NA
	Ground	17	55	15.50
Diuron	Aerial	0	0	NA
	Ground	9,991	325,306	32.56
Fluridone[3]	Aerial	0	0	NA
	Ground	0	0	NA
Glyphosate	Aerial	16,935	73,498	4.34
	Ground	9,861	85,492	8.67
Hexazinone[3]	Aerial	0	0	NA
	Ground	0	0	NA
Imazapic	Aerial	17,498	179,355	10.25
	Ground	3,696	53,588	14.50
Imazapyr	Aerial	3,501	69,075	19.73
	Ground	5,938	135,389	22.80
Metsulfuron methyl	Aerial	1,518	2,869	1.89
	Ground	10,398	51,470	4.95
Picloram	Aerial	3,905	45,063	11.54
	Ground	24,938	404,490	16.22
Sulfometuron methyl	Aerial	0	0	NA
	Ground	1,116	6,731	6.03
Tebuthiuron	Aerial	73,493	66,144	0.90
	Ground	133	162	1.22
Triclopyr	Aerial	106,580	576,006	5.32
	Ground	3,176	75,620	23.81

[1] Acres treated do not take into account whether the aerial application was by helicopter or airplane, nor do they distinguish between ground application methods. Costs would vary depending on the application method.
[2] Total herbicide expenditure and cost per acre do not include costs for labor, equipment, and application, and represent an average cost for use throughout the BLM.
[3] Herbicide not applied in 2011, so no data are available. Estimated costs are $548.63 per pound active ingredient for fluridone and $42.45 per pound active ingredient for hexazinone.
NA = Not available or not applicable.

TABLE 3-23
BLM Payments to States and Local Governments during Fiscal Year 2011

State	Payments in Lieu of Taxes[1]	Mineral Leasing Act[2]	Taylor Grazing Act			Proceeds of Sales	Other	Total Payments
			Section 3	Section 15	Other			
Alaska	$25,490,863	$4,064	$0	$0	$0	$0	$0	$25,494,927
Arizona	31,546,890	82,124	48,912	77,642	0	49,480	0	31,805,048
California	38,025,813	598,526	13,018	48,225	0	113,620	0	38,799,202
Colorado	27,022,334	514,788	63,511	29,612	18,632	29,940	0	27,678,817
Idaho	25,592,241	26,452	167,378	19,350	0	123,674	0	25,929,095
Montana	24,717,269	21,204	133,026	103,597	0	8,526	596,776	25,580,398
Nebraska	996,651	0	0	812	0	0	0	997,463
Nevada	22,942,298	105,787	213,384	3,168	0	118,288	1,025,321[3]	24,408,246
New Mexico	32,916,396	1,240,210	214,208	138,216	15	105,467	10,025	34,624,537
North Dakota	1,452,758	1,562	0	7,314	0	6	0	1,461,640
Oklahoma	2,639,362	0	0	65	0	0	0	2,639,427
Oregon	13,062,332	26,823	126,848	28,766	0	9,614	85,486,761[4]	98,741,144
South Dakota	4,995,110	0	0	0	0	0	0	4,995,110
Texas	4,629,597	0	0	0	0	0	0	4,629,597
Utah	34,659,277	694,786	132,435	0	0	27,200	0	35,513,698
Washington	13,843,603	0	0	22,651	0	11,505	0	13,877,759
Wyoming	25,656,797	1,084,182	160,744	332,280	31,313	86,234	0	27,351,550
Western States	290,689,191	4,400,508	1,273,46	811,698	49,960	683,554	87,118,883	385,027,258
All States	375,158,254	4,400,508	1,273,46	811,698	49,960	702,420	87,118,883	469,515,187

[1] Payments in lieu of taxes are made by the USDOI, Office of the Secretary, for tax-exempt federal lands administered by the BLM, National Park Service, USFWS, and Forest Service, as well as for federal water projects and some military installations.
[2] These are payments to states of 50 percent of mineral leasing ROW rents.
[3] Does not include direct payments of land sales under the Southern Nevada Public Land Management Act and some calendar year payments to Clark County, Nevada and the State of Nevada under the Santini-Burton Act because they were not reported to Treasury in 2012.
[4] These are Secure Rural Schools and Community-Self-Determination Act payments to 18 counties in Western Oregon authorized by Public Law 110-343.
Sources: USDOI 2011, USDOI BLM 2012b.

Disease Mortality

Mortality rates for the 17 western states in the BLM treatment area are listed in Table 3-24. The five most common causes of death in the U.S., as well as in these 17 states, are heart disease, cancer, respiratory disease, stroke (cerebrovascular diseases), and accidents (CDC 2011). Counties in the western U.S. that have the highest mortality rates are located in southern and eastern North Dakota, central Texas, southern New Mexico, and eastern Montana. Mortality rates are generally lowest in counties in central and western Colorado, Alaska, and northern Utah (CDC 2011). Mortality rates for males are nearly one and a half times those as for females, and mortality rates for African Americans over one and a quarter times those for Caucasians (CDC 2011).

Risks from Injuries

Injury Incidence

In 2011, nearly 32.4 million nonfatal injuries were reported in the U.S., almost 4.3 million of which were transportation related (CDC 2011). Injuries accounted for 29 percent of emergency department visits during 2010 (CDC 2011).

The rate of hospitalizations for injury is significantly higher among elderly persons than among all other age groups (CDC 2011). In 2010, more than 4,500 U.S. workers died from occupational injuries. Although difficult to enumerate, annually about 49,000 deaths are attributed to work-related illnesses. In 2010, an estimated 3.9 million workers in private industry and state and local government had a nonfatal occupational injury or illness (NIOSH 2012). Some chronic injuries

TABLE 3-24
Mortality Rates (per 100,000 Population)[1] and Causes of Death by State 2010

State	Cause of Death				
	All	Diseases		Cancer	Accidents[2]
		Cerebrovascular and Cardiovascular Disease	Chronic Respiratory Disease		
Alaska	771.5	192.4	41.5	176.9	58.7
Arizona	693.1	178.6	43.1	154.2	46.7
California	646.7	200.0	37.0	156.9	27.8
Colorado	682.7	168.9	49.7	149.5	43.5
Idaho	731.6	201.3	47.0	159.9	42.1
Montana	754.7	196.0	51.3	161.0	53.2
Nebraska	717.8	194.7	48.8	167.4	35.8
Nevada	795.4	230.6	49.5	174.2	41.3
New Mexico	749.0	189.6	47.7	152.4	60.7
North Dakota	704.3	200.9	43.1	157.1	38.8
Oklahoma	915.5	285.2	67.4	191.3	60.3
Oregon	732.1	178.0	45.3	173.9	37.8
South Dakota	715.1	195.1	46.0	171.0	44.5
Texas	772.3	225.5	43.0	165.9	39.0
Utah	703.2	180.3	33.1	133.7	40.6
Washington	692.3	188.5	40.4	170.5	37.6
Wyoming	778.8	207.0	59.5	172.6	59.8
United States	747.0	218.2	42.2	172.8	38.0

[1] Age-adjusted death rate per 100,000 population, which accounts for changes in the age distribution of the population.
[2] Accidents do not include motor vehicle accidents.
Source: CDC 2011.

may be directly linked to the nature of the work performed. For example, vibration syndrome affects a large proportion of workers using chippers, grinders, chainsaws, jackhammers, or other handheld power tools, causing blanching and reduced sensitivity in the fingers. The Bureau of Labor Statistics reported that in 2010, an estimated 29 percent of all work-related illness cases were due to musculoskeletal disorders (NIOSH 2012). Noise-induced hearing loss may also affect production workers who are exposed to noise levels of 80 decibels or more on a daily basis.

Acute trauma at work remains a leading cause of death and disability among U.S. workers. During the period from 1992 through 2011, more than 115,000 U.S. workers died from occupational injuries. The *Census of Fatal Occupational Injuries Summary* (U.S. Department of Labor Bureau of Labor Statistics 2013b) identified 4,693 workplace deaths from acute traumatic injury in 2011. Occupational fatalities resulted from numerous causes, including transportation incidents, falls, contact with objects and equipment, and homicides.

The occupational fatality rate in 2011 was approximately 3.5 fatalities per 100,000 employed. Fatality rates were highest for the agriculture, forestry, fishing, and hunting; mining; transportation; and construction industries. The fatality rate for the agriculture, forestry, fishing, and hunting sector was the highest, at 24.9 fatal industries per 100,000 workers. The mining sector had the second highest rate, at 15.9 fatalities per 100,000 employed. In the transportation and construction industries the rates were 15.3 and 9.1 fatalities per 100,000 employed, respectively. The largest number of fatal work injuries resulted from transportation and warehousing-related incidents, which accounting for 16 percent of workplace fatalities in 2011 (U.S. Department of Labor Bureau of Labor Statistics 2013b).

Injury Mortality

Over 180,000 Americans died from injuries nationwide in 2010. About 20 percent of these resulted from motor vehicle accidents, while other accidental deaths occurred from unintentional falls, drowning, and poisoning (CDC 2011). Injury is the leading cause of death and disability among children and young adults.

Risks from Cancer

Cancer Incidence

Nationwide, the chance of developing some form of cancer during one's lifetime is estimated to be about 40 percent (American Cancer Society 2012). There are many causes of cancer development, including occupational exposure to carcinogens, environmental contaminants, and substances in food. In the U.S., at least 30 percent of all cancer deaths and 87 percent of lung cancer deaths are attributed to tobacco smoking. Work-related cancers are estimated to account for 4 to 10 percent of all malignancies. It is difficult to quantify the information because of the long time intervals between exposure and diagnosis, personal behavior patterns, job changes, and exposure to other carcinogens. The NIOSH has reported that approximately 20,000 cancer deaths and 40,000 new cases of cancer each year in the U.S. are attributable to occupational hazards (NIOSH 2012). Millions of U.S. workers are exposed to substances that have tested as carcinogens in animal studies and it is estimated that less than 2 percent of chemicals in commerce have been tested for carcinogenicity (NIOSH 2012).

Cancer Mortality. Based on the data shown in Table 3-24, cancer accounted for between 19 and 25 percent of all deaths in the treatment states in 2010. Nationwide, cancers account for approximately 23 percent of all fatalities (CDC 2011). Cancer mortality rates are generally highest in Washington, California, South Dakota, and Oregon, and lowest in Utah, New Mexico, Oklahoma, and Montana, and differ depending on race and sex. Generally, males have higher rates of cancer mortality than females, and African Americans have higher rates than Caucasians.

Risks from Using Herbicides on Public Lands

Based on data from the USDOI accident reporting database (SMIS), there were five accidents involving ATV/UTVs and pesticide application between October 1, 2009 and June 16, 2014.

Risks from Wildfire Control on Public Lands

During FY 2013, 2,573 fires totaling 1,166,649 acres were suppressed on public lands. The number of human-caused fires was 838 and the number of lightning-caused fires was 1,735. Approximately 54 percent of fires occurred on rangelands and other non-forest lands. The remainder occurred in forests (USDOI BLM 2014e).

Wildfires cause the loss of life and property. According to the National Interagency Fire Center (2014), 34 people died from wildland fire-related accidents in 2013. From 2006 through 2011, the leading cause of firefighter deaths nationally, which include federal, state, and local firefighters and volunteers, as well as private individuals who were involved in direct support of wildland fire operations were: stress/overexertion (51.2 percent), vehicle/aircraft accidents (17.3 percent), and being caught or trapped (9.1 percent; U.S. Fire Administration 2013).

Legend

- Ecoregion Divisions
- BLM-administered Lands

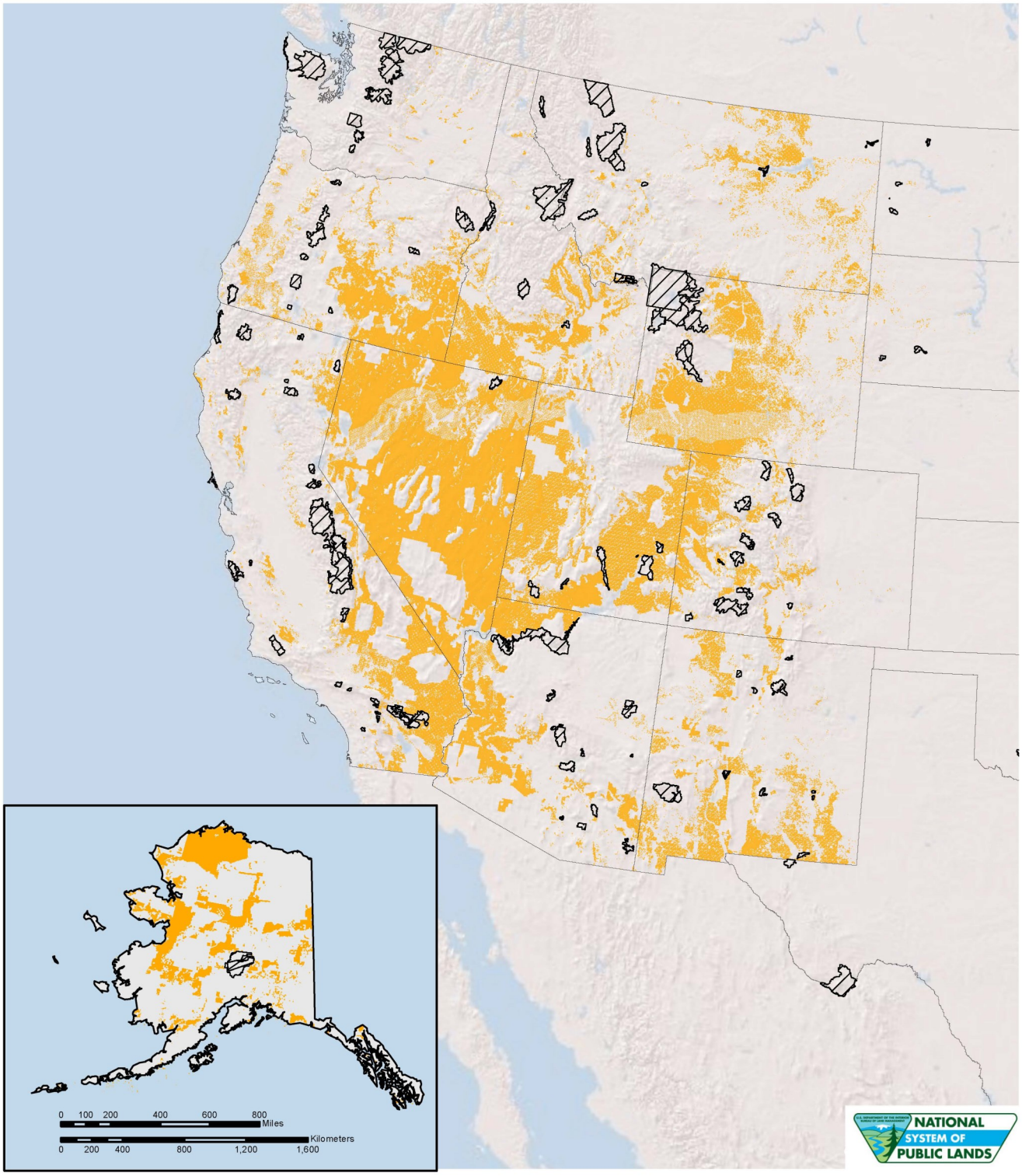
N W E S

Map 3-1
Ecoregion Divisions

0 50 100 200 300 400 Miles
0 50 100 200 300 400 Kilometers

Source: USDA Forest Service 2004a.
Note: Coverage for BLM-administered lands is not available for Texas, Nebraska, or Oklahoma.

No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completness of these data for individual or aggregate use with other data.
Original data were compiled from various sources. This information may not meet National Map Accuracy Standards.
This product was developed through digital means and may be updated without notice.



Legend

Class I Areas

BLM-administered Lands

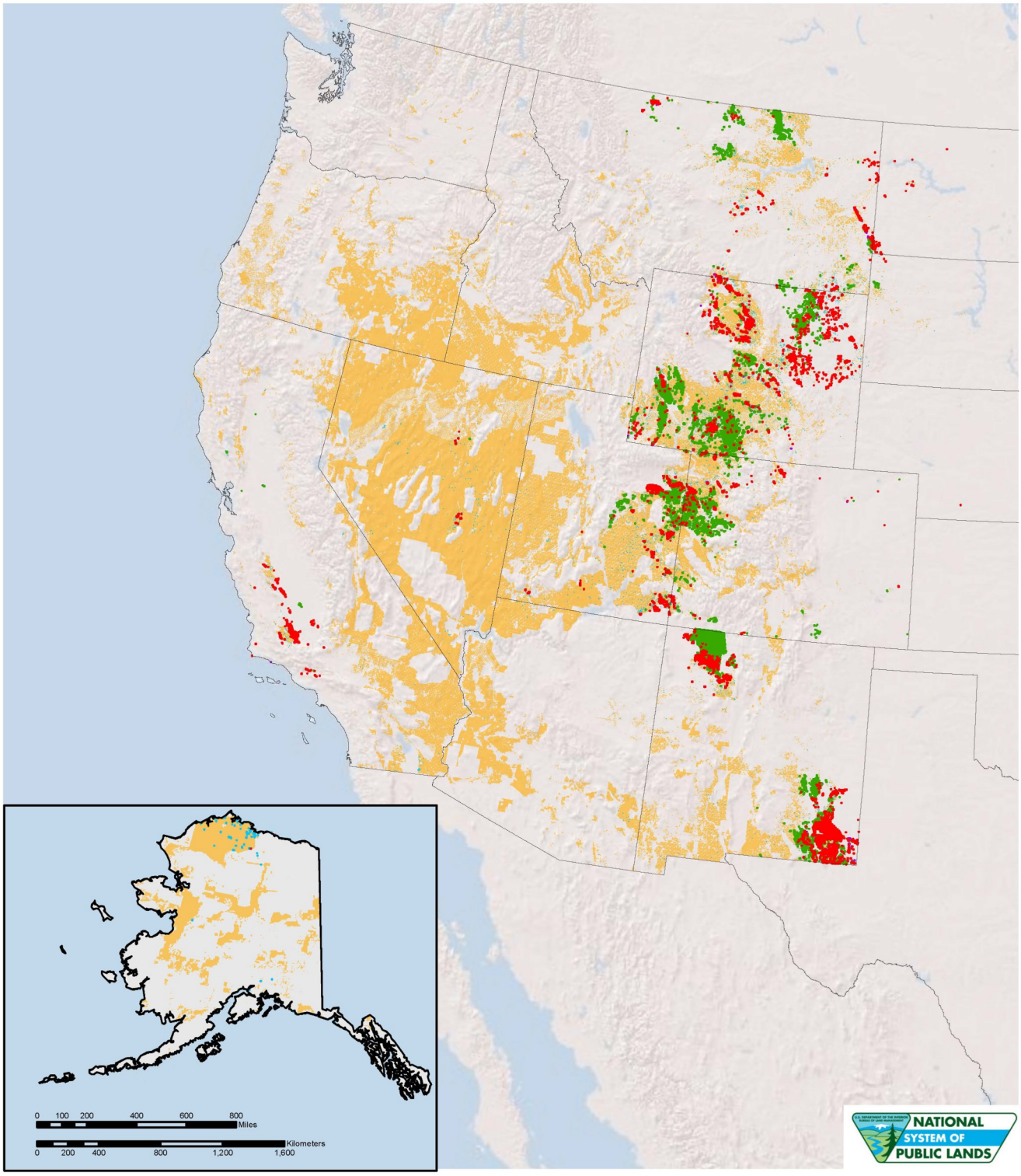
N
W E
S

Map 3-2
Class I Areas

0 50 100 200 300 400
Miles
Kilometers
0 50 100 200 300 400

Source: National Park Service 2007.
Note: Coverage for BLM-administered lands is not available for Texas, Nebraska, or Oklahoma.

No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completness of these data for individual or aggregate use with other data.
Original data were compiled from various sources. This information may not meet National Map Accuracy Standards.
This product was developed through digital means and may be updated without notice.



Legend

- BLM-administered Lands
- Oil Production
- Gas Production
- Mixed Production
- Dry Well

N W E S

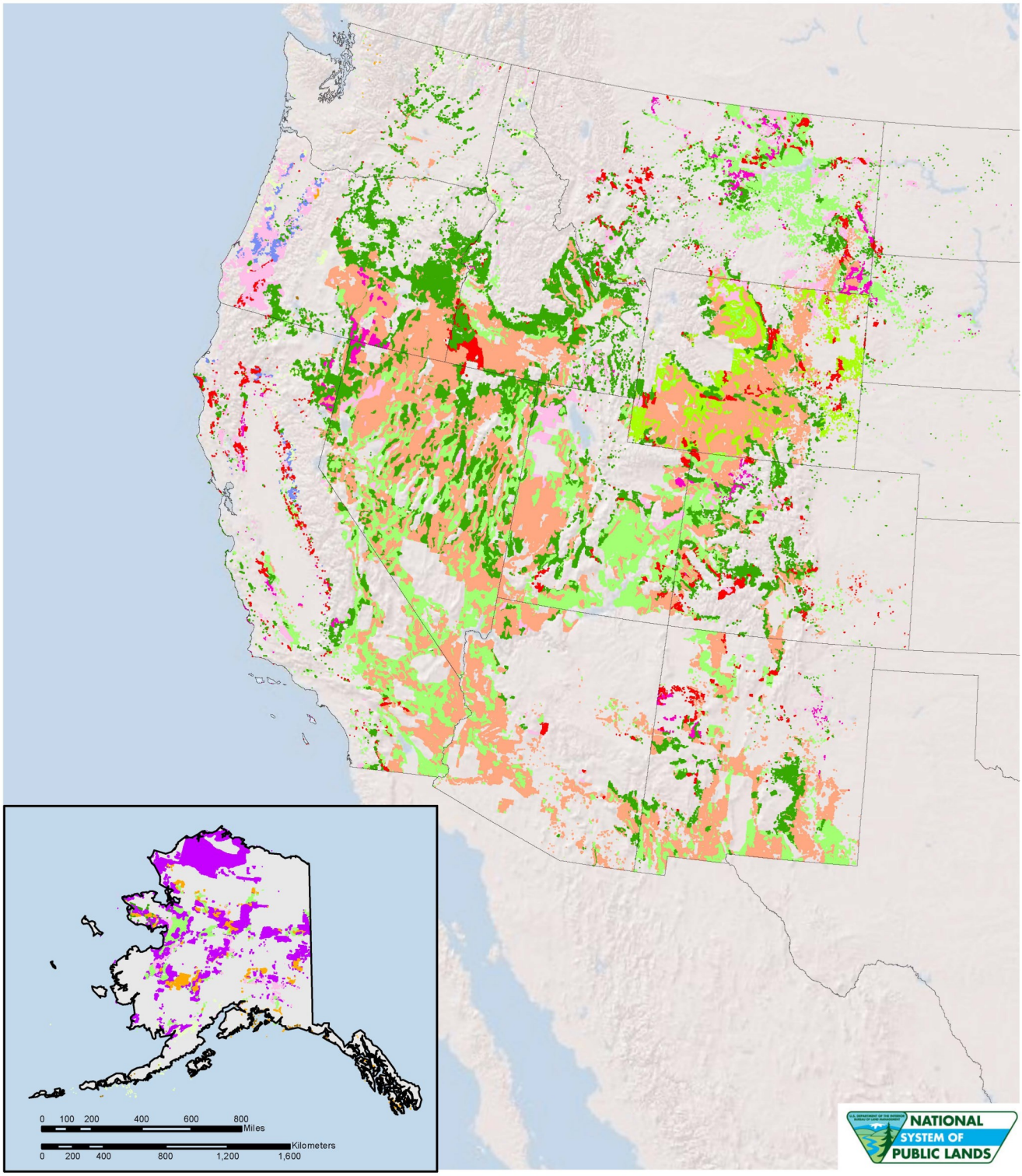
Map 3-3
Oil and Gas Wells on BLM-administered Lands

0 50 100 200 300 400 Miles

0 50 100 200 300 400 Kilometers

Source: USGS 2007.
Note: Coverage for BLM-administered lands is not avilable for Texas, Nebraska, or Oklahoma.

No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completness of these data for individual or aggregate use with other data.
Original data were compiled from various sources. This information may not meet National Map Accuracy Standards.
This product was developed through digital means and may be updated without notice.



Legend

- Alfisols
- Aridisols
- Andisols
- Entisols
- Gelisols
- Histosols
- Inceptisols
- Mollisols
- Spodosols
- Ultisols
- Vertisols

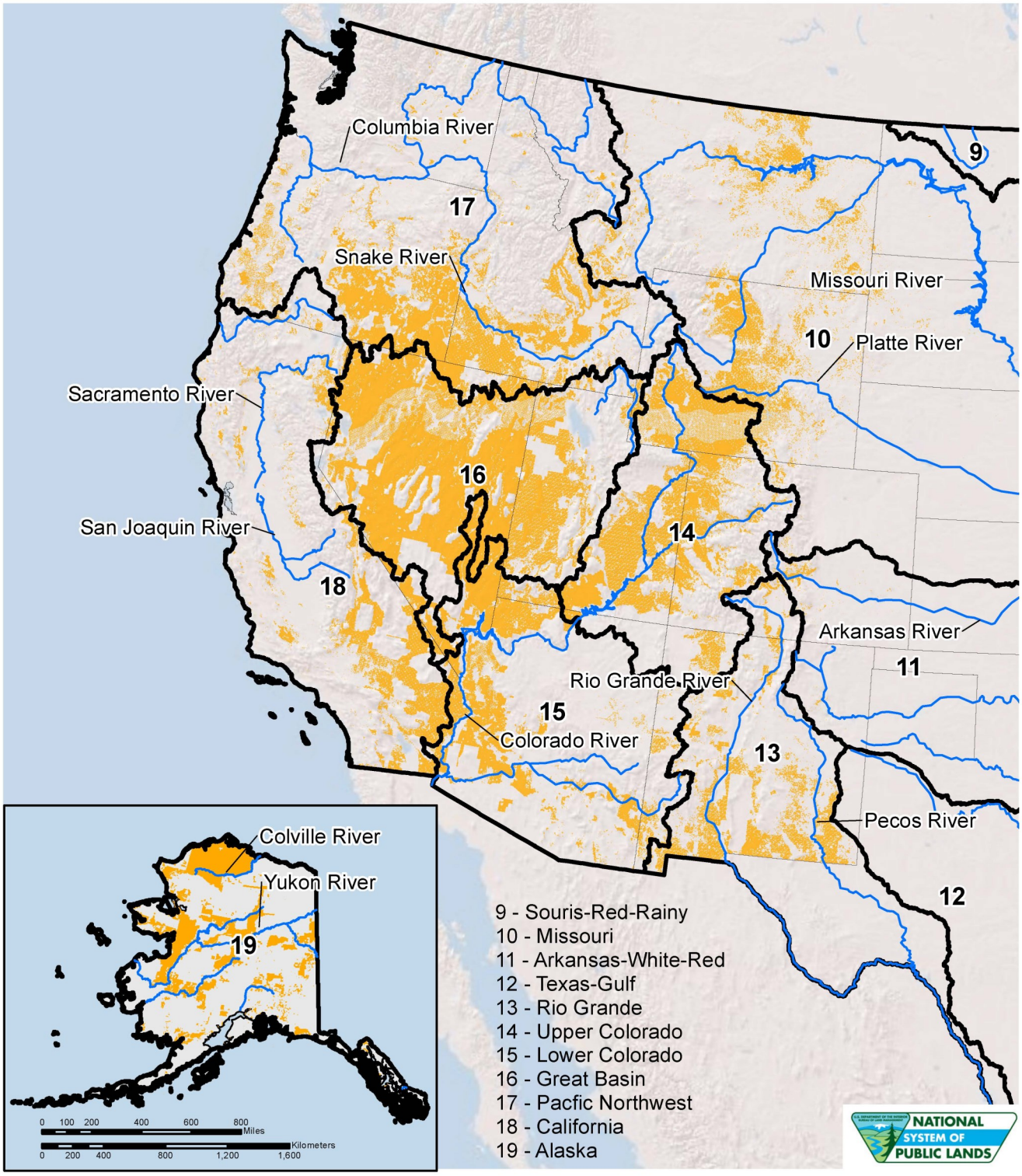
N W E S

Map 3-4
Soil Orders on Public Lands

0 50 100 200 300 400 Miles
0 50 100 200 300 400 Kilometers

Source: USDA National Resources Conservation Service 2000 to Present.
Note: Coverage for BLM-administered lands is not available for Texas, Nebraska, or Oklahoma.

No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completness of these data for individual or aggregate use with other data.
Original data were compiled from various sources. This information may not meet National Map Accuracy Standards.
This product was developed through digital means and may be updated without notice.



Legend

- BLM-administered Lands
- Hydrologic Regions
- Rivers

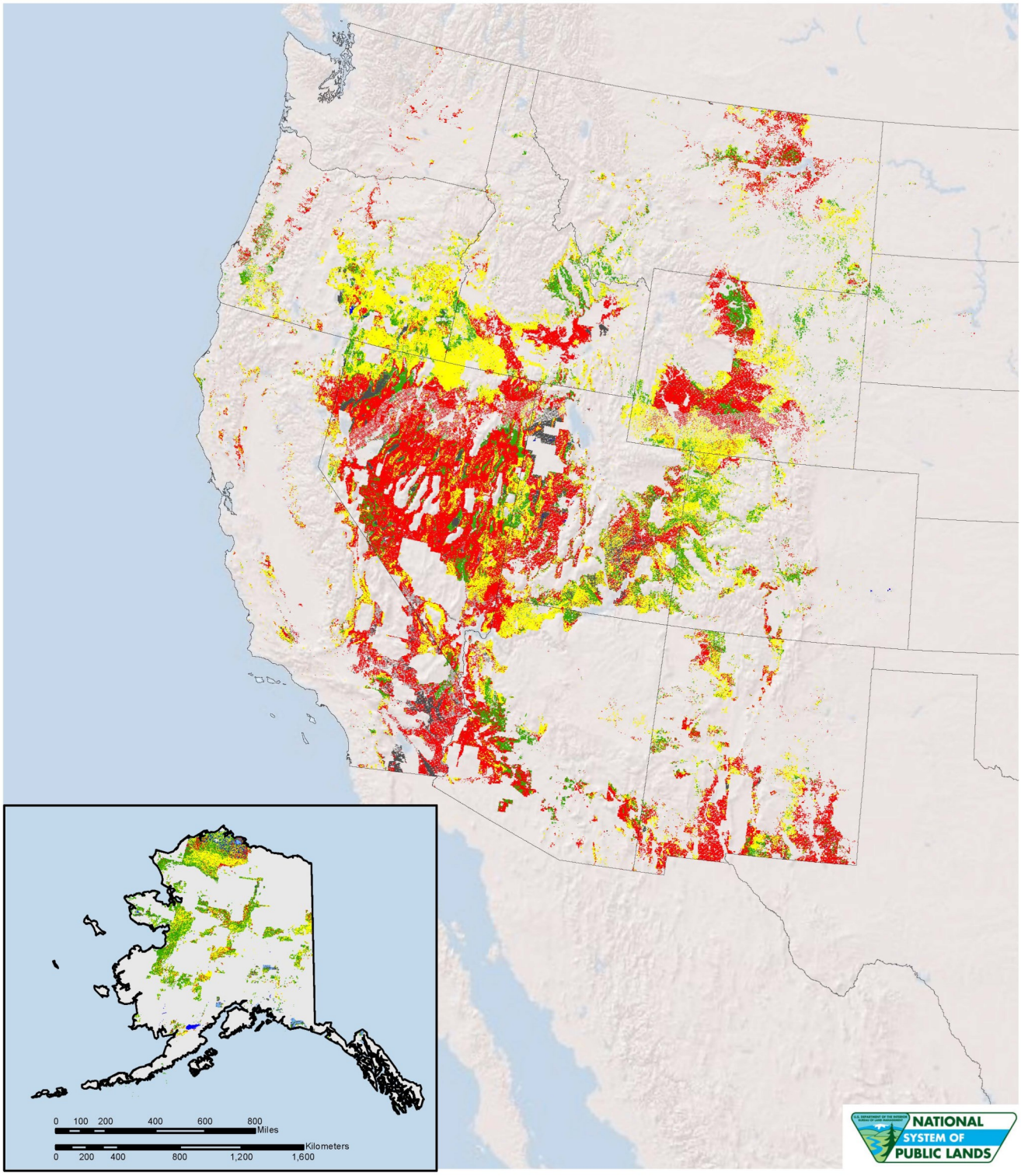
N W E S

Map 3-5
Hydrologic Regions

0 50 100 200 300 400 Miles
0 50 100 200 300 400 Kilometers

Source: USGS 2005b.
Note: Coverage for BLM-administered lands is not available for Texas, Nebraska, or Oklahoma.

No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completness of these data for individual or aggregate use with other data.
Original data were compiled from various sources. This information may not meet National Map Accuracy Standards.
This product was developed through digital means and may be updated without notice.



Legend

- Condition Class 1
- Condition Class 2
- Condition Class 3
- Water
- Snow/Ice
- Urban
- Agriculture
- Barren
- Sparsely Vegetated
- Unclassified

N W E S

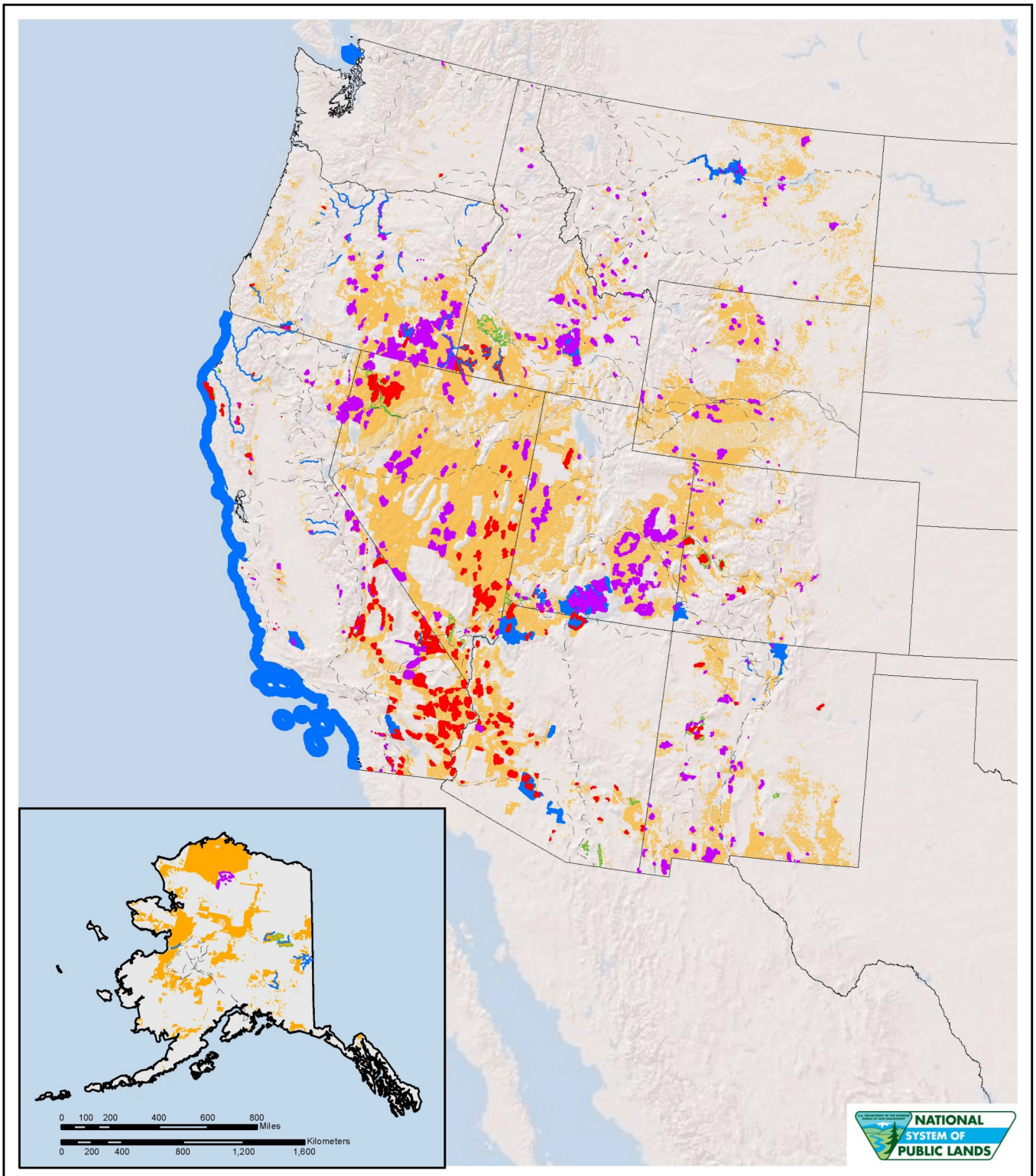
Map 3-6
Fire Regime Condition Classes on Public Lands

0 50 100 200 300 400 Miles

Kilometers 0 50 100 200 300 400

Source:Landfire 2010, 2011.
Note: Coverage for BLM-administered lands is not available for Texas, Nebraska, or Oklahoma.

No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completness of these data for individual or aggregate use with other data.
Original data were compiled from various sources. This information may not meet National Map Accuracy Standards.
This product was developed through digital means and may be updated without notice.



Legend

- Scenic or Historic Trails
- Wild and Scenic Rivers
- Wilderness Study Areas
- Wilderness Areas
- National Monuments
- BLM-administered Lands
- National Conservation Areas, Forest Reserves, Cooperative Management and Protection Areas, National Recreation Areas

N W E S

Map 3-7
National Landscape Conservation System Areas

0 50 100 200 300 400 Miles

0 50 100 200 300 400 Kilometers

Sources: USDI BLM 2013h.
Note: Coverage for BLM-administered lands is not available for Texas, Nebraska, or Oklahoma.

No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completness of these data for individual or aggregate use with other data.
Original data were compiled from various sources. This information may not meet National Map Accuracy Standards.
This product was developed through digital means and may be updated without notice.

CHAPTER 4

ENVIRONMENTAL CONSEQUENCES

CHAPTER 4

ENVIRONMENTAL CONSEQUENCES

Introduction

This chapter examines how herbicide treatment activities that utilize the three new active ingredients (aminopyralid, fluroxypyr, and rimsulfuron) may affect natural, cultural, and socioeconomic resources on public lands. The focus of the analysis is on the impacts associated with application of herbicide formulations that include the three active ingredients, and on the alternative proposals for use of these herbicides. These herbicides would be part of a larger vegetation management program, and would potentially be used in conjunction with other treatment methods and other currently approved herbicides. A summary of impacts associated with the use of the 18 currently approved herbicides and with other treatment methods can be found in the *Vegetation Treatments on Bureau of Land Management Lands in 17 Western States PEIS* (USDOI BLM 2007a) and *Vegetation Treatments on Bureau of Land Management Lands in 17 Western States PER* (USDOI BLM 2007c).

How the Effects of the Alternatives Were Estimated

Within each resource area, applicable direct and indirect effects are evaluated. Cumulative effects, unavoidable adverse effects, and resource commitments that are lost or cannot be reversed are identified in this PEIS. These impacts are defined as follows:

- Direct effects – Effects that are caused by the action and occur at the same time and in the same general location as the action.
- Indirect effects – Effects that occur at a different time or in a different location than the action to which the effects are related.
- Cumulative effects – Effects that result from the incremental impact of the action when it is added to other past, present, and reasonably foreseeable future actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time. For this PEIS, potential cumulative effects include those that could occur on other federal and non-federal lands. Cumulative effects also consider other types of vegetation treatments and treatments with other herbicides.
- Unavoidable adverse commitments – Effects that could occur as a result of implementing any of the action alternatives. Some of these effects would be short term, while others would be long term.
- Irreversible commitments – Commitments that cannot be reversed, except perhaps in the extreme long term. This term applies primarily to the effects of use of nonrenewable resources, such as minerals or cultural resources, or to factors, such as soil productivity, that are renewable only over long periods of time.
- Irretrievable commitments – Commitments that are lost for a period of time. For example, timber production is lost while an area is mined. The production lost is irretrievable, but the action is reversible. If the site is reclaimed, it is possible to resume timber production.

In addition, this PEIS considers the interaction of effects, as follows:

- Additive – total loss of resources from more than one incident.
- Countervailing – negative effects are compensated for by beneficial effects.
- Synergistic – total effect is greater than the sum of the effects taken independently.

This chapter should be read together with Chapter 2 (Alternatives), which explains the alternative proposals that the BLM is considering for use of the three new herbicide active ingredients for treating vegetation, and Chapter 3 (Affected Environment), which describes the important resources and their occurrence and status on public lands. The analyses of environmental

consequences in this chapter build upon and relate to information presented in these earlier chapters to identify which resources may be impacted and how and where impacts might occur.

Assumptions for Analysis

This analysis addresses large, regional-scale trends and issues that require integrated management across broad landscapes. It also addresses regional-scale trends and changes in the social and economic needs of people. This analysis does not identify site-specific effects because its focus is on broad-scale management direction. As discussed in Chapter 1, Proposed Action and Purpose and Need, site-specific issues would be addressed through environmental analyses prepared at the state, district, or field office level.

At the local level, the Ecosystem-Based Management approach would be used during development of site-specific management goals to ensure that they are informed and adapted from learning based on science and local knowledge.

The assumptions about vegetation treatments that were made in the 2007 PEIS (USDOI BLM 2007a:4-1 to 4-2) carry over in this PEIS, as the new herbicides would be integrated into current treatment programs.

Vegetation treatments are implemented with consideration for the larger land management context in which they occur. The BLM considers whether and how treatment areas will be revegetated or stabilized to ensure the long-term viability of the project area. The BLM strives to minimize long-term increases in bare ground resulting of treatment from vegetation treatments, which might allow invasive plants to increase in abundance. Treated vegetation is removed from the site if it poses a further risk as hazardous fuel.

The impacts analysis assumes the following:

- Vegetation treatments would be developed and applied in an Integrated Pest Management context, where all treatment methods, costs, and goals are considered.
- Tool(s) identified for the treatment would be the appropriate means to achieve the project objective.
- Post-treatment follow-up such as seeding, monitoring, and retreatment would occur, as needed to achieve land management objectives.
- Maintenance of past treatments has occurred, and the BLM would maintain improved vegetation conditions, rather than implementing stand-alone, one-time treatments.
- The BLM would determine the need for the action based on inventory data and monitoring. Post-treatment monitoring would occur after the project to ascertain its effectiveness in achieving the resource objective(s).
- The BLM would comply with federal, state, tribal, and local regulations that govern activities on public lands.
- SOPs and applicable mitigation listed in the 2007 PEIS (USDOI BLM 2007a: Table 2-8) and ROD (USDOI BLM 2007b: Table 2) would continue to be followed by the BLM under all alternatives to ensure that risks to human health and the environment would be kept to a minimum.

Examples of SOPs that pertain to all resource areas include the following:

- Conduct a pre-treatment survey for sensitive resources.
- Identify the most appropriate treatment method. If chemicals are the appropriate treatment, then select the chemical that is least damaging to the environment while providing the desired results.
- Consider surrounding land uses before selecting aerial spraying as a treatment method.
- Apply the least amount of herbicide needed to achieve the desired results.
- Prepare a spill contingency plan in advance of treatment.
- Notify adjacent landowners prior to treatment.
- Require licensed applicators to apply herbicides.
- Use only USEPA-approved herbicides, and follow product label directions and “advisory” statements.

- Follow the product label for use and storage.
- Review, understand, and conform to the "Environmental Hazards" section on the herbicide label. This section warns of known pesticide risks to the environment and provides practical ways to avoid harm to organisms or the environment.
- Avoid accidental direct spray and spill conditions to minimize risks to resources.
- Avoid aerial spraying during periods of adverse weather conditions.
- Make helicopter applications at a target airspeed of 40 to 50 miles per hour (mph), and at about 30 to 45 feet above ground.
- Keep a copy of Material Safety Data Sheets (MSDSs) at work sites.
- Keep records of each application.
- Implement additional applicable SOPs specific to individual resources, which are provided in the impact analysis section for each resource.

Additionally, mitigation measures specific to treatments with the three new herbicides have been identified for certain resource areas in Chapter 4. These mitigation measures could further reduce impacts associated with herbicide treatments.

Incomplete and Unavailable Information

According to the Council on Environmental Quality regulations for implementing the procedural provisions of NEPA (40 CFR 1502.22), if the information is essential to a reasoned choice among alternatives and the cost of gathering it is not excessive, it must be included or addressed in the PEIS.

Generally, the types of incomplete and unavailable information are the same as those described in the 2007 PEIS (USDOI BLM 2007a:4-3 to 4-4). Although knowledge about many aspects of terrestrial and aquatic species, forestland, rangelands, the economy, and society is still incomplete, the alternatives were evaluated using the best available information.

Ecological and human health risk assessments were developed by the BLM for aminopyralid, fluroxypyr, and rimsulfuron to address many of the risks that would be faced by humans, plants, and animals, including special status species, from the use of these three active ingredients. To assess risks to other resources from the use of herbicides, the BLM consulted information in the risk assessments and supporting documentation; state, federal, and local databases, Geographic Information System (GIS) data, and contract reports; subject experts within and outside of the BLM; and the current literature.

A programmatic analysis over a 17-state area generally summarizes information that may be available at finer scales (e.g. at the regional and local level), but is too de-centralized and dispersed to be presented effectively. In these cases such information will be presented during analysis at the local level to make more informed decisions about specific treatment projects involving aminopyralid, fluroxypyr, and rimsulfuron.

While additional information may add precision to estimates or better specify relationships, new or additional information is unlikely to significantly change the understanding of the relationships that form the basis of the effects analysis presented in this chapter.

Subsequent Analysis before Projects

Before site-specific actions are implemented and an irreversible commitment of resources is made, information essential to fine-scale decisions will be obtained by the local land managers. Localized data and information will be used to supplement or refine regional-level data and identify methods and procedures best suited to local conditions in order to achieve the objectives in this PEIS. Further analysis would be necessary to deal with site-specific conditions and processes. For example, mitigation measures identified in the following sections (and in the 2007 PEIS) would be appropriate for protecting resources under the wide range of conditions that must be considered at the programmatic level of analysis. However, by considering more site-specific parameters, such as soil and vegetation type and amount of rainfall, the BLM may be able to use less restrictive mitigation measures and still ensure adequate protection of the resource. It is also possible that more restrictive measures would be necessary. This subsequent analysis will be used to bridge the gap between broad-scale direction and site-specific decisions. This "step-down" analysis involves subsequent NEPA analysis at various levels, which may include the regional or statewide level, the district or

field office level, and the local or project-specific level (USDOI BLM 2007a:1-19).

Program Goals by Ecoregion

The goals of herbicide treatments were developed for the 2007 PEIS, and are presented by ecoregion in the following sections. These goals continue to represent what the BLM hopes to achieve through the use of vegetation treatments on public lands, and are being carried forward in this PEIS. Herbicide treatments with the three new herbicides would be incorporated into the larger treatment program designed to meet these goals.

Temperate Desert Ecoregion

Over 70 percent of herbicide treatments would occur on BLM land in the Temperate Desert Ecoregion. Most of these treatments would be used to meet vegetation and integrated weed management (IWM) objectives (as outlined in BLM Manual 9015 [USDOI BLM 1992]; 33 percent of treatments), reduce hazardous fuels (25 percent), conduct emergency stabilization and burned area rehabilitation activities (19 percent), and improve rangeland health (12 percent). Improvements of wildlife habitat and watershed health are objectives of lesser importance (6 and 5 percent of treatments, respectively) in this ecoregion.

Temperate Steppe Ecoregion

In the Temperate Steppe Ecoregion, most herbicide treatments would be conducted to meet integrated vegetation management (IVM) and/or IWM objectives (62 percent of treatments). Other important objectives include hazardous fuels reduction (25 percent) and improvement of rangeland health (11 percent).

Subtropical Steppe Ecoregion

On BLM lands in the Subtropical Steppe Ecoregion, herbicide treatments would be used to improve habitat (38 percent of treatments), improve rangeland health (21 percent), reduce hazardous fuels (17 percent), and meet IVM and/or IWM objectives (11 percent).

Mediterranean Ecoregion

In the Mediterranean Ecoregion, chemical treatments would be conducted primarily to improve forest health (35 percent of treatments), and to meet maintenance-related (28 percent) and IVM and/or IWM (20 percent) objectives. Improvement of rangeland health (9 percent) and recreation areas (6 percent) would also be important objectives.

Marine Ecoregion

On BLM lands in the Marine Ecoregion, the majority of herbicide treatments would be conducted to meet IVM and/or IWM (69 percent) and maintenance-related (22 percent) objectives. Some less important treatment objectives include maintaining ROWs (3 percent), improving forest health (3 percent), and improving habitat for native vegetation (3 percent).

Subtropical Desert Ecoregion

Less than 1 percent of herbicide treatments would occur on BLM land in the Subtropical Desert Ecoregion. Herbicide treatments in this ecoregion would focus on managing woody species that have invaded shortgrass and mixed-grass prairies and riparian areas of the desert southwest.

Tundra and Subarctic Ecoregions

Herbicide treatments in this ecoregion would occur on a very small portion of public lands in these ecoregions. It is estimated that no more than 1,000 acres of public lands in Alaska would be treated with herbicides in any year. Goals of future herbicide treatments in these ecoregions would be to control invasive species in disturbed areas (along trails and roads, and at heavy use areas) to prevent their spread into more pristine areas.

Land Use

Laws, regulations, and plans that pertain to land use are summarized in the 2007 PEIS (BLM 2007a:4-5). The FLPMA of 1976 directs the BLM to manage public lands to protect their resource values, and to develop resource management plans consistent with those of state and local governments. Management actions on public lands are guided by land use plans, which establish goals and objectives for resource management.

Similar to the 2007 PEIS, this PEIS is a national-level programmatic analysis. It contains broad regional descriptions of resources, provides a broad environmental impact analysis, and provides Bureau-wide decisions on herbicide use for vegetation management. Additionally, it provides an umbrella ESA Section 7 consultation for the broad range of activities described in the PEIS.

Impacts to land uses have not been identified at the programmatic level. It is assumed that vegetation treatments by all methods would continue to occur on up to 6 million acres annually, that treatments would continue to focus on areas with high levels of hazardous fuels and invasive plants, that land uses would comply with the intent of Congress as stated in the FLPMA (43 U.S.C. 1701 et seq.), and that future land uses would be similar to those that currently occur on public lands.

Adding new active ingredients to the BLM's list of approved herbicides would be expected to have a minimal effect on land uses. Herbicide treatments would continue to be conducted over the same geographic area and with the same program goals, and so would have no additional effects. However, it is assumed that under all alternatives, existing land use plans will be updated to include additions to the approved herbicide list, with modifications occurring primarily at the field office level.

Air Quality and Climate

Air quality is the measure of the atmospheric concentration of defined pollutants in a specific area. Air quality is affected by pollutant emission sources, as well as the movement of pollutants in the air via wind and other weather patterns. This air quality analysis focuses on the release of criteria pollutants and greenhouse gases associated with herbicide treatments.

Scoping Comments and Other Issues Evaluated in the Assessment

Scoping comments requested that this PEIS quantify greenhouse gas emissions from the proposed project activities.

Emission Sources and Impact Assessment Methodology

The potential impacts of herbicide use on air quality originate primarily from ground vehicle (truck, all-terrain vehicle [ATV]/utility terrain vehicle [UTV], and boat) and aircraft (plane and helicopter) emissions, as well as fugitive dust (dust created by vehicle travel on unpaved roads) resulting from herbicide transport and application. In addition, spray drift (movement of herbicide in the air to unintended locations) and volatilization (the evaporation of liquid to gas) of applied herbicides temporarily results in herbicide particles in the air, which can be inhaled and deposited on skin or plant surfaces and affect humans, wildlife, and non-target plants. Herbicide particles can be transported away from the target location, depending on weather conditions and the herbicide application method.

Methodology for Assessing Impacts to Air Quality

The methodology for assessing impacts to air quality from herbicide applications is discussed in detail in the 2007 PEIS (USDOI BLM 2007a:4-6 to 4-8). Additional information on methodology, data sources, and results may be found in the air quality report that was prepared as supporting documentation for the 2007 PEIS (ENSR 2005). The air quality methodology includes calculating annual emissions for the proposed alternatives by state from vehicle exhaust and fugitive dust (from travel on unpaved roads). Emissions were calculated for CO, nitrogen oxides (NO_x), total suspended particles (TSP), PM_{10}, $PM_{2.5}$, and volatile organic compounds (VOCs). Annual exhaust emissions were determined using emission factor data for vehicles likely to be used in herbicide treatments and for transportation, and assumptions about periods of operation. It should be noted that the 2007 PEIS used 1998 emission factors, and therefore likely overestimates emissions using newer vehicles. Table 4-1 presents the annual emissions for Alternative B of the 2007 PEIS, which carries over to all the alternatives considered in this analysis (as the total treatment acreage would not change). Annual fugitive dust emissions were determined using emission factors that considered trip mileage and soil properties. Prevention of Significant Deterioration (PSD) levels are used in this analysis as criteria to indicate whether the herbicide use alternatives would significantly affect air quality.

The USEPA's California Puff (CALPUFF) "lite" air pollutant dispersion model (a first level screening model referenced in Appendix W of 40 CFR Part 51) was used to provide an example of potential TSP and PM emissions resulting from a single herbicide spraying event. Spray drift from various herbicide application methods was assessed using the AgDrift model.

As the current proposed action adds new active ingredients to the list of herbicides approved for use by the BLM, but does not increase the total amount of herbicide application, a new analysis of emissions of criteria pollutants has not been completed for this PEIS. However, since the 2007 PEIS did not consider GHG

TABLE 4-1
Annual Emissions Summary for Herbicide Treatments under All Alternatives

State	Pollutant (tons per year)					
	CO	NO_X	TSP	PM_{10}	$PM_{2.5}$	VOCs
Alaska	0.00	0.00	0.00	0.00	0.00	0.00
Arizona	3.40	0.41	14.66	3.09	0.42	0.24
California	0.54	0.06	2.37	0.50	0.07	0.04
Colorado	2.06	0.24	4.88	1.07	0.14	0.18
Idaho	24.22	2.92	60.35	13.18	1.67	1.71
Montana	4.97	0.60	11.58	2.58	0.32	0.35
Nebraska	0.00	0.00	0.00	0.00	0.00	0.00
Nevada	10.81	1.26	47.63	10.18	1.39	0.75
New Mexico	4.85	0.54	17.73	3.97	0.54	0.40
North Dakota	0.00	0.00	0.00	0.00	0.00	0.00
Oklahoma	0.00	0.00	0.00	0.00	0.00	0.00
Oregon (Total)	5.00	0.57	28.77	6.97	0.99	0.34
Eastern	1.31	0.15	2.55	0.56	0.07	0.09
Western	3.87	0.43	26.22	6.40	0.91	0.26
South Dakota	0.08	0.01	0.20	0.05	0.01	0.01
Texas	1.07	0.13	2.46	0.55	0.07	0.08
Utah	2.42	0.28	8.56	1.88	0.25	0.21
Washington	0.43	0.05	1.01	0.23	0.03	0.03
Wyoming	2.42	0.28	5.69	1.24	0.16	0.21
Total	62.27	7.35	205.89	45.49	6.06	4.55

Source: USDOI BLM 2007a.

emissions, a GHG emission analysis has been completed for this EIS. Mobile source GHG emissions were estimated using emission factor data for vehicles likely to be used in herbicide treatments and for transportation, using 2009 model year emission factors. A quantitative analysis of carbon sequestration (adsorption of atmospheric carbon dioxide by vegetation and stored in woody biomass) was not conducted, as there is no appropriate protocol for evaluating impacts of land use changes on atmospheric carbon release and sequestration.

Standard Operating Procedures

The 2007 PEIS (USDOI BLM 2007a:4-8 to 4-9) lists SOPs that the BLM follows to minimize the potential adverse effects of herbicide use on air quality. These SOPs would continue to apply to herbicide treatments involving aminopyralid, fluroxypyr, and rimsulfuron:

- Consider the effects of wind, humidity, temperature inversions, and heavy rainfall on herbicide effectiveness and risks.
- Apply herbicides in favorable weather conditions to minimize drift. For example, do not treat when winds exceed 10 mph (6 mph for aerial applications) or rainfall is imminent.
- Use drift reduction agents, as appropriate, to reduce the drift hazard.
- Select proper application equipment (e.g., spray equipment that produces 200- to 800-micron diameter droplets [spray droplets of 100 microns and less are most prone to drift]).
- Select proper application methods (e.g., set maximum spray heights and use appropriate buffer distances between spray sites and non-target resources).

Additionally, all guidance provided in BLM manuals and handbooks would continue to be followed.

Impacts by Alternative

Impacts Common to All Alternatives

Based on the air quality analysis presented in the 2007 PEIS (USDOI BLM 2007a:4-9 to 4-13), the potential impacts from herbicide applications on local and

regional air quality would be minor under all of the treatment alternatives. Additionally, since the total area treated using herbicides would be the same under all of the alternatives, differences in air quality emissions between alternatives would be minor.

Annual Air Quality Emissions

None of the predicted annual emissions by pollutant, state, or alternative would exceed PSD annual emission significance thresholds. Furthermore, under each alternative, the total emissions from all the states for each pollutant would be less than 25 percent of the PSD threshold (250 tons per year) for a single facility. Comparing the total emissions produced by all the states to the PSD threshold is especially conservative because the PSD threshold is designed to apply to one facility or a group of facilities and not entire states. Potential emissions would be highest in states with the greatest number of acres treated. Based on CALPUFF "lite" modeling, all PM concentrations resulting from a single example herbicide spraying event would be substantially lower than NAAQS thresholds at five representative locations, and predicted concentrations would be at least four orders of magnitude smaller than assumed background concentrations (Table 4-2).

Spray Drift and Volatilization

Under all alternatives, atmospheric concentrations of herbicides (predicted by particle size) resulting from spray drift from aerial, ground vehicle, and hand applications would be temporary in nature (most predominant at the time and location of treatment) and, as predicted by modeling, would not significantly impact air quality. Based on modeling, herbicide concentrations in the air tend to increase up to 1.5 kilometers (km) from the point of application (concentrations may double between 0.6 and 1.5 km from the application site), but then decrease slowly at greater distances.

Chemical volatilization is temporary in nature, and none of the currently approved herbicides or the three proposed for use are likely to result in substantial volatilization from soils. Chemical vapor pressure (the pressure exerted by a vapor in equilibrium with its solid or liquid phase) largely affects the potential for volatilization of applied herbicides. Based on their vapor pressures, aminopyralid, fluroxypyr, and rimsulfuron are not expected to volatilize from dry soil surfaces, and are essentially non-volatile from water and moist soil (U.S. National Library of Medicine 2006, 2011, 2012). Therefore, application of these herbicides would not impact air quality through volatilization.

Greenhouse Gas Analysis

Estimated annual GHG emissions from the project were determined based on the methodology described under Methodology for Assessing Impacts to Air Quality, which can be found earlier in this Air Quality and Climate section. GHG Emissions associated with vehicles (ground and aerial) used to transport and apply herbicides were calculated, based on projections for trip mileage made for Alternative B of the 2007 PEIS. More information on the procedures used to estimate emissions, including uncertainties and assumptions, can be found in the *Annual Emissions Inventory for BLM Vegetation Treatment Methods* (ENSR 2005). As the total assumed treated acreage under that alternative (931,850) would be the same under all the alternatives analyzed in this document, there is no difference under the alternatives as far as GHG emissions.

Based on a total herbicide treatment acreage of 931,850 acres, the proposed herbicide treatments would generate approximately 3,333 $MTCO_2e$/yr of CO_2, 14 $MTCO_2e$/yr of N_2O, and 2 $MTCO_2e$/yr of methane (CH_4). Therefore, total GHG emissions associated with the herbicide treatments under all the alternatives is approximately 3,350 $MTCO_2e$/yr. A comparison of this number to total emissions for the western U.S. helps provide an indication of the magnitude of GHG emissions associated with the project. Based on a review of GHG inventories provided by the USEPA (2014), not all 17 states covered in the analysis area have completed an inventory; no data are available for Idaho, Nebraska, North Dakota, or Wyoming. For the remaining 13 states in the Western U.S., total combined reported annual GHG emissions is approximately 1,400 MMT (million metric tons) CO_2e/yr. Estimated annual project-related emissions are 0.0002 percent of this total, and 0.00006 percent of the annual national reported GHG emissions of 5,546.3 $MMTCO_2e$/yr. Therefore, none of the alternatives would generate a significant amount of GHG emissions.

TABLE 4-2
Example NAAQS Compliance Analysis for Herbicide Treatments under All Alternatives

Location	Pollutant	Averaging Period	CALPUFF Concentration (µg/m^3)	Background Concentration[1] (µg/m^3)	Total Concentration (µg/m^3)	NAAQS Standard[2] (µg/m^3)
Tucson, Arizona	TSP	24-hour	2.79E-04	40	40	NA
		Annual	7.65E-07	11	11	NA
	PM_{10}	24-hour	5.47E-04	30	30	150
		Annual	1.50E-06	8	8	50
	$PM_{2.5}$	24-hour	7.21E-05	30	30	35
		Annual	1.97E-07	8	8	15
Glasgow, Montana	TSP	24-hour	1.06E-04	40	40	NA
		Annual	2.90E-07	11	11	NA
	PM_{10}	24-hour	2.36E-04	30	30	150
		Annual	6.48E-07	8	8	50
	$PM_{2.5}$	24-hour	2.82E-05	30	30	35
		Annual	7.74E-08	8	8	15
Winnemucca, Nevada	TSP	24-hour	1.36E-04	40	40	NA
		Annual	3.72E-07	11	11	NA
	PM_{10}	24-hour	2.72E-04	30	30	150
		Annual	7.44E-07	8	8	50
	$PM_{2.5}$	24-hour	3.60E-05	30	30	35
		Annual	9.85E-08	8	8	15
Medford, Oregon	TSP	24-hour	3.75E-03	40	40	NA
		Annual	1.04E-05	11	11	NA
	PM_{10}	24-hour	8.20E-03	30	30	150
		Annual	2.28E-05	8	8	50
	$PM_{2.5}$	24-hour	1.14E-03	30	30	35
		Annual	3.19E-06	8	8	15
Lander, Wyoming	TSP	24-hour	6.08E-05	40	40	NA
		Annual	1.67E-07	11	11	NA
	PM_{10}	24-hour	1.37E-04	30	30	150
		Annual	3.75E-07	8	8	50
	$PM_{2.5}$	24-hour	1.72E-05	30	30	35
		Annual	4.70E-08	8	8	15

[1] PM_{10} data from Table 5 of the Montana Modeling Guideline for Air Quality Permits (November 2007; Montana Department of Environmental Quality 2007). TSP concentrations calculated by multiplying PM_{10} data by 1.33. PM_{10} concentrations are also conservatively used as background concentrations for $PM_{2.5}$.
[2] None of the states analyzed have ambient air quality standards for TSP.
NA = Not applicable; and µg/m^3 = micrograms per cubic meter.

Alternative A – Continue Present Herbicide Use (No Action Alternative)

The No Action Alternative corresponds to the Preferred Alternative in the 2007 PEIS. The air quality analysis for this alternative assumed that 932,000 acres would be treated using herbicides annually. While the BLM has not come close to this maximum acreage since the release of the ROD for the 2007 PEIS, for the purposes of this analysis, the tables from the 2007 PEIS (reprinted as Tables 4-1 and 4-2 in this document) are still considered to be suitable, conservative estimates. As indicated in Table 4-1, total pollutant emissions would include approximately 206 tpy TSP, 62 tpy CO, and 45 tpy PM_{10}. Total GHG emissions would be 3,350 $MTCO_2e$/yr. These emissions would continue to dominate in states with the greatest number of acres treated. While Table 4-1 assumes that the greatest treatment acreage would occur in Idaho and Nevada, in reality more extensive herbicide treatments occurred in

New Mexico during 2006 to 2011. However, no states had treatment acres that reached or exceeded the estimate for Idaho. Therefore, Table 4-1 should be used as a guide, with the understanding that the proportion of treatment acres by a state in any given year is likely to shift over time. Idaho, Nevada, New Mexico, Oregon, and Wyoming are likely to continue to be among the states with the greatest annual air quality emissions.

Although not quantified, herbicide treatments under Alternative A would be expected to have a positive effect on air quality by reducing the risk of wildfire. Smoke and wildfire cause short-term impacts to visibility and air quality, predominantly through the release of PM and CO. Actions to reduce wildfire risk would continue to have an indirect effect on air quality, depending on the efficacy of fuels reduction treatments.

Alternative B – Allow for Use of Three New Herbicides in 17 Western States (Preferred Alternative)

Under the Preferred Alternative, it is expected the total annual emissions of criteria pollutants and greenhouse gases would be more or less the same as under the No Action Alternative. With the introduction of the three new active ingredients, the BLM would change its relative use of herbicides, but the total area treated is still assumed to be 932,000 acres. Likewise, it is assumed that there would be no difference in the method of application for the new herbicides. As under the No Action Alternative, it is expected that the greatest release of air quality pollutants would likely occur in Idaho, Nevada, New Mexico, Oregon, and Wyoming.

Benefits to air quality from reduction of wildfire risk would be similar to those under the No Action Alternative. Treatments would continue to target cheatgrass and other fire fuels.

Alternative C – No Aerial Application of New Herbicides

Under this alternative, the new herbicides would not be available for treatments involving aerial application methods. Instead, currently approved herbicides would continue to be utilized for plane and helicopter treatments. Therefore, it is expected that the overall extent of aerial applications would be the same as at present and under the other action alternatives. Total releases of air quality pollutants, including criteria pollutants and greenhouse gases also would be no different than under the other alternatives. Similar to Alternatives A and B, it is expected that the greatest release of air quality pollutants would likely occur in Idaho, Nevada, New Mexico, Oregon, and Wyoming.

Benefits to air quality from reduction of wildfire risk would be similar to those under the other alternatives.

Alternative D – No Use of New Acetolactate Synthase-inhibiting Active Ingredients (No Rimsulfuron)

Under Alternative D, total emissions of air quality pollutants would be much the same as under the other alternatives. Although rimsulfuron would not be available for use under this alternative, currently approved herbicides (such as aminopyralid) would continue to be used to meet treatment goals, and the total area treated with herbicides by aerial and ground methods would be similar to the area treated under the other alternatives. Therefore the total emissions of criteria pollutants and GHGs would be about the same as under the No Action Alternative and the other action alternatives. Similar to the other alternatives, it is expected that the greatest release of air quality pollutants would likely occur in Idaho, Nevada, New Mexico, Oregon, and Wyoming.

Benefits to air quality from reduction of wildfire risk would be similar to those under the other alternatives.

Mitigation for Herbicide Treatment Impacts

No mitigation measures are proposed for air quality.

Soil Resources

Introduction

Soil is an essential component of natural ecosystems, providing habitat for a great variety of organisms and a medium for plant growth, and protecting downgradient ecosystems by serving as a physical and biological filter of chemicals in the environment (Wild 1993).

Noxious weeds and other invasive vegetation can impact soil function and reduce soil biodiversity. The amount of moisture in the soil can be altered if infiltration is reduced and runoff is increased on sites dominated by invasive plants (Lacey et al. 1989). Many noxious weeds and other invasive plants have relatively sparse canopies, which allow for greater evaporation from the exposed soil than dense vegetative cover. Sites

infested with invasive plants often have more extreme soil temperatures that can alter soil moisture regimes. Noxious weeds and other invasive plants may alter soil nutrient availability for native species, alter soil constituents (e.g., soil fungi and bacteria), and slow the rate of natural plant succession (Olson 1999a). Some weeds also produce toxins or allelopathic compounds that can suppress the growth and germination of other plants (Kelsye and Bedunah 1989).

Herbicide applications inevitably result in contact with soils, either intentionally for systemic treatments, or unintentionally as spills, overspray, spray drift, or windblown dust. In addition to direct application, transmission to soil may occur when an herbicide is transported through the plant from sprayed aboveground portions to roots, where it may be released into soil. Also, some herbicides remain active in plant tissue and can be released into the soil during plant decay and result in residual herbicide activity.

Scoping Comments and Other Issues Evaluated in the Assessment

Several scoping comments were concerned with the persistence of the herbicides in soil and residual soil activity, particularly in regard to aminopyralid. Herbicide fate in soil and the potential for transport of the herbicide from the treatment site on wind-blown soil particles were also concerns.

Standard Operating Procedures

The BLM would continue to implement the SOPs identified in the 2007 PEIS to reduce impacts to soil:

- Minimize treatments in areas where herbicide runoff is likely, such as steep slopes when heavy rainfall is expected.
- Minimize use of herbicides that have high soil mobility, particularly in areas where soil properties increase the potential for mobility.
- Do not apply granular herbicides on slopes of more than 15 percent where there is the possibility of runoff carrying the granules into non-target areas.

In addition, the BLM follows practices, when implementing herbicide treatments, which help minimize effects to soil. The BLM considers herbicide and target site characteristics to determine the suitability of the herbicide at that location. Knowledge of herbicide persistence, mobility, and adsorption are included in herbicide selection. Additionally, herbicide applications are timed in relation to soil moisture and anticipated weather conditions to reduce the potential for off-site transport. Herbicide applications are avoided when the soil moisture status and site characteristics increase the possibility of runoff or deep percolation.

Factors that Influence the Fate, Transport, and Persistence of Herbicides in Soil

The fate and transport of herbicides in soil is a function of their interaction with the soil environment, and is generally considered a complex process (Bovey 2001). Chemical, physical, and biological soil processes influence herbicide availability, phytotoxicity, and fate and transport. Herbicides dissipate from soils by transport with water or wind, through chemical or biological degradation processes, or by immobilization through adsorption onto soil surfaces. These processes are discussed in more detail in the 17-States PEIS (USDOI BLM 2007a:4-14 to 4-15). The estimated half-life and soil adsorption (organic carbon-water partitioning coefficient) of the three herbicides considered in this PEIS are presented in Table 4-3.

TABLE 4-3
Estimated Soil Half-life (Aerobic Conditions) and Adsorption Affinity for Active Ingredients

Herbicide	Soil Half-life (days)	Soil Adsorption (K_{oc})
Aminopyralid	32 to 533	1.05 to 24.3 mL/g
Fluroxypyr	23	50 to 136 mL/g
Rimsulfuron	5 to 40	19 to 74 mL/g

Sources: USEPA 2005b, New York State Department of Environmental Conservation (NYSDEC) 2009, U.S. National Library of Medicine 2011.
mL/g = milliliters per gram.

Soil structure affects water movement and may allow herbicides to move through the soil profile before being absorbed or degraded. Large soil cracks or openings can cause rapid herbicide movement. Soil texture affects the surface charge and the surface area for pesticide adsorption. Soils with a higher clay content have a greater ability to hold pesticides, but are more susceptible to runoff. Sandy soils leach more readily and provide fewer sites for pesticide adsorption. Organic matter content is considered the most important soil property affecting pesticide adsorption. Pesticides are very strongly attracted to the surface of organic

matter and are less likely to leach in soils high in organic matter.

Impacts of Herbicide Treatments

The following section discusses impacts to soil from the three active ingredients proposed for use. This assessment of impacts assumes that SOPs listed in the 2007 PEIS (USDOI BLM 2007a:Table 2-8) would be followed when using the three herbicides. SOPs are designed to reduce potential unintended impacts to soil. These procedures include using the lowest effective application rate; testing smaller areas for unintended consequences prior to treating larger areas; evaluating soil characteristics to determine the likelihood of herbicide transport by runoff, infiltration, or wind; limiting herbicide use on fine-textured and sandy soils, especially where soil can be transported onto adjacent areas potentially harming non-target vegetation; and carefully evaluating the use of herbicides on hot, dry, cold, wet, sodic (containing high levels of sodium), and saline (containing high levels of salts) soils.

Herbicides may indirectly affect soil through plant removal, resulting in changes in physical and biological soil parameters. As vegetation is removed, there is less plant material to intercept rainfall and less to contribute organic material to the soil. Loss of plant material and soil organic matter can increase the risk of soil susceptibility to wind and water erosion. The risk for increased erosion would be temporary, lasting only until vegetation is reestablished. If herbicide treatments lead to revegetation with native plants, soil stability may be improved relative to sites dominated by invasive plants.

Use of herbicides to manage noxious weeds and other non-native, invasive species could benefit soil. Invasive plants can increase the potential for wind or water erosion by altering fire frequency or producing chemicals that directly affect soil quality or organisms. Negative effects associated with invasive plant species include increased sediment deposition and erosion, and alteration of soil nutrient cycles (Bossard et al. 2000). For example, soft brome changes the physical characteristics of soil and alters the cycling of carbon and nitrogen (Norton et al. 2004).

Cheatgrass and other annual grasses increase the risk of fire, so control of these species can minimize risk of fire damage to soil. Soil can be damaged by fire through changes to its structure, particularly through the loss of organic matter, which can occur even at relatively low temperatures. The loss of soil structure increases the bulk density of the soil and reduces its porosity, thereby reducing soil productivity and making the soil more vulnerable to postfire runoff and erosion (Neary et al. 2005).

The potential effects of herbicides on biological soil crusts are discussed in the 2007 PEIS (USDOI BLM 2007a:4-15 to 4-16). Past studies have shown both positive and negative effects to biological soil crusts as a result of herbicide treatments. Cyanobacteria, lichen, and moss constituents may be impacted to varying degrees. However, use of herbicides can also benefit biological soil crusts by preventing the invasion of annual grasses, which reduce biological crust cover. The BLM's guidance manual on biological soil crusts instructs that caution should be used when applying herbicides to soils that support these crusts (Belnap et al. 2001).

Impacts of Aminopyralid

Aminopyralid is broken down in the soil by microbes and sunlight. Studies of aminopyralid show a wide range of soil half-lives under aerobic conditions (from 5 to 533 days; as summarized in AECOM 2014a). Given the variability, there is some uncertainty as to how long this active ingredient persists in the environment after application. Dow AgroSciences (2005) lists the average half-life for aminopyralid at 34.5 days for North American soils. A recent study in Colorado found that the half-life of aminopyralid was approximately 29 days, with no appreciable herbicide residue left after 1 year (Lindenmyer 2012). It is expected that aminopyralid remains active in the soil for a month or more after application, and may have residual activity during this time.

Based in its low toxicity to terrestrial invertebrates (AECOM 2014a), aminopyralid is believed to be of low toxicity to soil macroorganisms. However, there is a lack of information about its toxicity to soil microorganisms, and about associated long-term effects to soil productivity.

Aminopyralid is persistent in plant materials and the manure of animals that have eaten plant materials treated with this herbicide. Therefore, compost and mulch made from contaminated plants and/or manure, if applied to soil, can adversely affect crops and other plantings (Washington State University Extension 2011). These contaminated materials should not be used as soil amendments.

Aminopyralid is weakly sorbed (attached by physical or chemical processes) to soil (Fast 2010), and therefore is unlikely to be transported off-site in large amounts on wind-blown soil.

Impacts of Fluroxypyr

Fluroxypyr is rapidly degraded in soil by microorganisms, with reported half-lives of 1 week to 23 days under aerobic conditions (Lehmann 1991, USEPA 1998a, National Library of Medicine 2011). In one study, only 1 percent of the active ingredient was detected after 3 months (Brumhard and Fuhr 1992 *cited in* National Library of Medicine 2011). Fluroxypyr is mobile to very mobile in soil, but its movement is reduced by its quick microbial degradation. Fluroxypyr has very minimal residual soil activity

Fluroxypyr has two major metabolites: a pyridine and a methoxypyridine. Fluroxypyr degrades first to the pyridine and then to the methoxypyridine, which is persistent in soil (Lehmann 1991; Cederlund et al. 2012). This second degradate has a high tendency to adsorb to soil, and is slowly degraded in place by microbial degradation and volatilization (Lehmann 1991). In one study, no significant degradation of the second degradate was observed after 350 days (Cederlund et al. 2012); however, another study observed soil half-lives of 90 to 570 days under various laboratory conditions (Lehmann et al. 1990).

Based in its low toxicity to terrestrial invertebrates (AECOM 2014b), fluroxypyr is believed to be of low toxicity to soil macroorganisms. However, there is a lack of information about its toxicity to soil microorganisms. Long-term effects to soil productivity and biological processes are not known.

Given its rapid degradation, high mobility in soil, and minimal residual activity, there would be a low risk of transport of fluroxypyr off of the treatment site in windblown soil. The amount adsorbed to soil would be much less than the amount applied to the treatment site, and would rapidly dissipate. The second degradate would persist for longer and could be transported off the treatment site.

Impacts of Rimsulfuron

Rimsulfuron breaks down rapidly in soil, with aerobic metabolism the primary route of degradation. In aerobic conditions, it has a soil half-life of 5 to 40 days, and in anaerobic conditions, it has a soil half-life of 18 days (NYSDEC 2009). Its mobility in soil ranges from moderate in clay and silt loams to very mobile in sandy loams.

One study of rimsulfuron found that it is poorly mineralized, and that degradation products have the potential to accumulate in soil. Rimsulfuron degrades into a first metabolite, which then degrades rapidly into a second metabolite. The second metabolite is not readily degraded (Metzger et al. 1998). In one study of an aerobic soil environment, there was no decline in this chemical after 1 year. There is no indication that this degradate exhibits toxicological properties (NYSDEC 2009).

One study of rimsulfuron found that there were no adverse effects to the microflora of agricultural soils for standard application rates of the herbicide (Radivojevic et al. 2011). At much higher application rates, minor, transitory adverse effects to soil microorganisms were observed, indicating that short-term adverse effects to soil could occur under accidental spill scenarios. Long-term effects to soil productivity and biological processes are not known.

Rimsulfuron's tendency to adsorb to soil varies by soil type, and is greatest in soils with high organic matter or clay content (Metzger et al. 1998). Therefore, there is some potential for transport off-site on soil particles, although clay and high-organic soils would likely have a relatively low potential for wind erosion.

Impacts by Alternative

The BLM proposes use of herbicides to treat vegetation to improve ecosystem function and health, including soil health. However, herbicide treatments can also affect soil fertility and function, and can kill or harm soil organisms. The benefits and risks to soil under each alternative are discussed in the following sections.

Alternative A – Continue Present Herbicide Use (No Action Alternative)

Under the No Action Alternative, the BLM would continue its vegetation treatment programs, using only the 18 currently approved herbicides. Herbicide treatments would have both beneficial and adverse effects on soil, as discussed in the previous sections. Herbicides would continue to be used on approximately 932,000 acres annually.

Of the 18 active ingredients that would be used under this alternative, those that are most persistent in soil include diquat, diuron, hexazinone, imazapic, imazapyr,

picloram, and tebuthiuron (USDOI BLM 2007a:Table 4-7). Diquat has a half-life of 3 years or longer, but its use would continue to be minimal (less than 1 percent of all acres treated). Tebuthiuron has a half-life of roughly 1 year. Its use would constitute 13 percent of all acres treated under the No Action Alternative. Other herbicides with half-lives of 90 days or greater would make up approximately 30 percent of all herbicide treatment acres.

Under this alternative, the herbicides with the most extensive use on BLM lands would be imazapic (20 percent), triclopyr (15 percent), clopyralid (13 percent), and tebuthiuron (13 percent; see Table 2-4). Impacts to soil from these herbicides are discussed in the 2007 PEIS (USDOI BLM 2007a:4-16 to 4-21). None of these herbicides have been found to have substantial impacts on soil or soil organisms. Tebuthiuron is extremely persistent in soil, and has been detected at application sites more than 10 years after application (Gay et al. 1997 *cited in* USDOI BLM 2007a).

Alternative B – Allow for Use of Three New Herbicides in 17 Western States (Preferred Alternative)

Under the Preferred Alternative, the total area receiving herbicide treatments would remain the same (932,000 acres), but the suite of chemicals used at individual sites would change with the introduction of aminopyralid, fluroxypyr, and rimsulfuron into treatment programs. Aminopyralid would be used on approximately 10 percent, and rimsulfuron on approximately 16 percent, of all acres treated. Use of fluroxypyr would be minimal (1 percent of all acres). Fluroxypyr and rimsulfuron have relatively short half lives in soil (Table 4-3). Aminopyralid also has a fairly short half-life, but there is evidence that it may be quite persistent (with a half-life of more than a year) under certain site conditions. Additionally, plant materials and residues that have been treated with aminopyralid may continue to release aminopyralid to the soil until these materials have decomposed. None of new herbicides proposed for use have been found to have substantial impacts on soil or soil organisms.

With the addition of the three new herbicides, use of some previously-approved herbicides is expected to decrease, as shown in Table 2-4. Under the Preferred Alternative, use of glyphosate, imazapic, and picloram would decrease by 4 to 10 percent of the total acres treated. Imazapic and picloram have fairly long half-lives, relative to the new herbicides. Therefore, the overall persistence of herbicides in soil could be reduced under the Preferred Alternative. Overall, potential adverse effects to soil and soil organisms would be minor, although potentially less than those under the No Action Alternative.

If availability of the new herbicides were to increase the efficacy of the BLM's vegetation treatment programs, resulting in better control of noxious weeds and of invasive species that increase fire frequency, there may be a slightly greater benefit to soil resources than under the No Action Alternative.

Alternative C – No Aerial Application of New Herbicides

Under Alternative C, vegetation treatments would utilize the same suite of chemicals as under Alternative B, and the same maximum number of acres as under the other alternatives, but a restriction on aerial application of the new herbicides would result in slight differences in the relative amounts of herbicides used. As shown in Table 2-4, use of the new herbicides would be less than under the Preferred Alternative, and the associated reductions in use of glyphosate, imazapic, and picloram would also be less. Therefore, overall soil persistence would fall somewhere between the No Action Alternative and the Preferred Alternative. Impacts to soil would be minor, similar to the other alternatives.

Benefits to soil resources could be slightly greater than under the No Action Alternative, and slightly less than under the Preferred Alternative.

Alternative D – No Use of New Acetolactate Synthase-inhibiting Active Ingredients (No Rimsulfuron)

Under this alternative, the BLM would not add rimsulfuron to its list of approved active ingredients. However, all currently approved ALS-inhibiting herbicides would continue to be used. As a result, the breakdown of herbicide usage would be very similar to that under the No Action Alternative. Because rimsulfuron would not be available to manage cheatgrass and other winter annuals, the BLM would continue to rely heavily on imazapic for these uses. With the introduction of aminopyralid, use of glyphosate would be reduced. Glyphosate and aminopyralid have similar soil half-lives, and under certain conditions aminopyralid may be more persistent than glyphosate. Overall, impacts to soil resources would be minor, and would be very similar to those under the No Action Alternative. It is expected that benefits to soil from control of noxious weeds and other

invasive vegetation also would be similar to those under the No Action Alternative.

Mitigation for Herbicide Treatment Impacts

No mitigation measures are proposed for soil resources.

Water Resources and Quality

Introduction

The proposed herbicide treatments have the potential to affect water resources on or near public lands by altering water flows, surface water and groundwater quantity and quality, and rates of groundwater recharge. Surface water provides an important source of drinking water, provides habitat for fish and wildlife, and is used for recreation. Groundwater has numerous uses, including irrigation, drinking water (for humans and livestock), domestic needs, aquaculture, and other uses (USGS 2013). Approximately 44 percent of the U.S. population depends on groundwater for its drinking water supply (National Groundwater Association 2010).

Studies have shown some groundwater supplies to be contaminated with herbicides and other contaminants (e.g., total dissolved solids and metals). Generally, shallow groundwater aquifers are at greater risk for contamination than deeper sources. As discussed in the 2007 PEIS (2007a:3-15 to 3-18) and Chapter 3 of this PEIS, water quality is poor to moderate over many areas in the West, primarily in areas associated with agricultural activities. Thus, actions that further deteriorate water quality or watershed health need to be carefully evaluated before being implemented on public lands.

Scoping Comments and Other Issues Evaluated in the Assessment

Scoping comments were concerned about the potential for the new herbicides to adversely affect water quality. Comments addressed herbicide drift, erosion of contaminated soils into waterways, and contamination of surface water, groundwater, and drinking water. One comment noted that aminopyralid has been detected in surface water in Montana. Another comment inquired about how invasive infestations of aquatic plants would be controlled (to prevent deterioration of water quality) if buffers are required around water bodies for treatments involving the new herbicides.

One comment mentioned the requirements of the Clean Water Act, and requested that the BLM show that use of the new herbicides would not result in degradation of water quality of Section 303(d)-listed waters, and indicate how other anti-degradation provisions of the Clean Water Act would be met.

Other commenters showed support for the new herbicides by noting that they are safe to use around water and how low risk of resulting in water contamination.

Standard Operating Procedures

The BLM would continue to implement the SOPs identified in the 2007 PEIS to reduce unintended impacts to water quality and quantity from the application of herbicides:

- Consider climate, soil type, slope, and vegetation type when developing herbicide treatment programs.
- Note depths to groundwater and identify areas of shallow groundwater and areas of surface water and groundwater interaction.
- Review hydrogeologic maps of proposed treatment areas or conduct site reconnaissance to identify areas of shallow groundwater.
- Select herbicide products to minimize impacts to water. This is especially important for application scenarios that involve risk from active ingredients in a particular herbicide, as predicted by risk assessments.
- Use local historical weather data to choose the month of treatment. Based on the phenology of the target species, schedule treatments based on the condition of the water body and existing water quality conditions.
- Plan to treat between weather fronts (calms) and at the appropriate time of day to avoid high winds that increase spray drift and water movements, and to avoid potential stormwater runoff and water turbidity.
- When possible, plan to treat shallow areas, which are easier to control.

- Conduct mixing and loading operations in an area where an accidental spill would not contaminate an aquatic body.
- Do not rinse spray tanks in or near water bodies.
- Do not broadcast pellets where there is danger of contaminating water supplies.
- Minimize treating areas with high risk for groundwater contamination.
- As needed, maintain buffers between treatment areas and water bodies. Buffer widths should be developed based on herbicide- and site-specific criteria to minimize impacts to water bodies.
- Minimize the potential effects to surface water quality and quantity by stabilizing terrestrial areas as quickly as possible following treatment.

These SOPs are general to herbicide treatments, and would apply to treatments with the three new active ingredients, as applicable.

Additionally, the ROD for the 2007 PEIS has identified two mitigation measures for herbicide treatments that apply to the three new active ingredients:

- Establish appropriate (herbicide-specific) buffer zones to downstream water bodies, habitats, and species/populations of interest. These buffer zones are based on information provided in the risk assessments indicating the minimum safe distance to protect aquatic organisms.
- Areas with potential for groundwater for domestic or municipal water use shall be evaluated through the appropriate, validated USEPA model(s) to estimate vulnerability to potential groundwater contamination, and appropriate mitigation measures shall be developed if such an area requires the application of herbicides and cannot otherwise be treated with nonchemical methods.

Summary of Herbicide Impacts

Aminopyralid, fluroxypyr, and rimsulfuron would only be used on terrestrial vegetation; none of these herbicides are currently approved for aquatic uses. Aminopyralid, however, may receive an aquatic registration in the near future that would address incidental overspray of this active ingredient during treatment of vegetation within close proximity to wetland and riparian vegetation. Aminopyralid would not be used to manage aquatic vegetation as a result of this registration, and would not be applied directly to the water column like other aquatic herbicides.

Impacts to Water Quality

The four primary means of off-site movement of terrestrial herbicides to water are runoff, leaching, drift, and misapplication/spills. If aminopyralid receives an aquatic registration, it could also reach water through incidental overspray (direct spray). Surface water could be affected by any of these types of herbicide movement, while groundwater potentially would be affected only by leaching. Site conditions and application technique are other factors that can influence the effects of an herbicide on water quality. Pollution results from herbicide concentrations that are elevated enough to impair water quality and the beneficial use of the impacted water (USDOI BLM 1991). The 2007 PEIS (USDOI BLM 2007a:4-26 to 4-29) goes into detail about the general ways by which herbicides can impact water quality by the four means of off-site movement. This information is summarized in the following paragraphs.

Runoff and Leaching. Three physical properties, in combination with climate, geology, and topography, determine the runoff and leaching potential of an herbicide: 1) persistence (the time a chemical stays active); 2) soil adsorption (the tendency of a chemical to bind to soil particles); and 3) solubility (the tendency of a chemical to dissolve in water; Bonneville Power Administration 2000).

Table 4-4 lists the factors associated with herbicide movement to groundwater, and Table 4-5 lists the physical properties of the three active ingredients proposed for use and the associated off-site movement potential via leaching and runoff. Herbicides must be relatively persistent to have the potential to leach or runoff. Herbicides that adsorb strongly to soil particles (because of herbicide and/or soil properties) tend to run off with soil movement. Soils high in organic content or clay tend to be the most adsorptive, while sandy soils low in organic content are typically the least adsorptive (USDOI BLM 1991). Herbicides with low soil adsorption tend to leach down through the soil, although herbicides with low solubility in water may be more

TABLE 4-4
Factors Associated with Herbicide Movement to Groundwater

Category	Properties Increasing Likelihood of Groundwater Detection
Herbicide properties	Greater mobility (lower adsorption) Greater pesticide persistence (lower reactivity)
Agricultural management practices	Higher pesticide use Increasing proximity to pesticide application areas Reductions in depth or frequency of tillage
Well characteristics	Decreasing well depth Dug or driven (versus drilled) wells Poorer integrity of surficial or annular well seals
Hydrogeologic and edaphic factors	Unconsolidated aquifer materials (versus bedrock) Decreasing depth of upper surface of aquifer Decreasing thickness or absence of confining layers Higher hydraulic conductivity Higher soil permeability Increased recharge (from precipitation or irrigation) Younger groundwater age
Source: Barbash et al. 1999.	

TABLE 4-5
Herbicide Physical Properties and Off-site Movement Potential

Herbicide	Physical Properties			Off-site Movement Potential	
	Persistence	Solubility (mg/l)	Adsorption (Koc)	Groundwater Leaching	Surface Water Runoff
Aminopyralid	Moderate	2,480	1 to 24	High	High
Fluroxypyr	Low	7,300	50 to 136	Low	Low
Rimsulfuron	Low	7	19 to 74	Low	Low

Note: The information in this table applies to the active ingredient itself, not the degradation products.
Sources: USEPA 2005c, NYSDEC 2009, U.S. National Library of Medicine 2011, 2012.

likely to run off. Site characteristics that may affect the likelihood of an herbicide reaching a water body via runoff or leaching include amount of precipitation, depth to groundwater, and soil type.

Drift. The airborne movement of herbicides beyond the treatment area is one mode of potential surface water contamination. The application technique, weather conditions, and applicator error can all contribute to drift. Broadcast treatments from an aircraft or a boom are more likely to drift from the treatment area than spot and localized treatments. The potential for drift is also increased during warm temperatures and wind speeds greater than 5 mph (Bonneville Power Administration 2000). Because of the potential for drift, buffers between the treatment site and nearby water bodies may be specified to protect aquatic species.

Misapplications and Spills. Herbicides registered for use in terrestrial habitats may affect surface water and groundwater as a result of unintentional spills or accidental direct spray of water. Most experts agree that misapplications and spills are the leading cause of impacts to non-target resources. Misapplications and spills are caused by failure to follow label instructions and restrictions, unforeseen conditions and accidents, and by applicator carelessness. The impacts of a spill depend on the persistence and mobility of the spill, as well as how quickly the spill is cleaned up.

Other Factors. Additional factors that may influence the potential for herbicides to affect water quality include the following:

- Type of water body (small and still water bodies versus large and fast-moving rivers);
- Amount of rainfall;

- Type of vegetation (thick vegetation versus little to no vegetation); and
- Application technique (aerial/broadcast versus spot treatments).

Herbicides can also affect water quality by contributing to increased nutrient loading to surface water and groundwater. Nutrient enrichment of aquatic systems can lead to algal blooms and eutrophication (mineral and organic nutrient loading and subsequent proliferation of plant life), resulting in decreased dissolved oxygen content.

Benefits to water quality from herbicide treatments are associated with a reduced risk of fire and post-fire sedimentation. Additionally, control of invasive species in terrestrial and aquatic systems can provide long-term benefits to water quality with the return of more stable soils, attenuated nutrient cycling, and a return to normal fire cycles.

Impacts to Water Quantity

Removal of vegetation through use of herbicides has the potential to affect water quantity by altering the magnitude of base flows and the frequency and magnitude of peak flows. Such effects would be most likely to occur as a result of large-scale removal of vegetation as a result of broadcast spraying. For some treatment areas, the removal of vegetation could improve groundwater recharge by limiting the amount of water lost through sublimation or plant evapotranspiration. In this case, base flows, which are dependent on the quantity of groundwater discharge, would increase. These changes could be very minor or short-lived if the vegetation did not evapotranspirate or sublimate large proportions of precipitation, or if areas were revegetated quickly (Satterlund and Adams 1992).

Under some circumstances, large-scale removal of vegetation could result in the reduction of groundwater discharge and base flow as a function of reduced infiltration rates. Reduced infiltration rates result in more surface runoff reaching streams and lakes immediately after a rain event, thus increasing the velocity, frequency, and magnitude of peak stream flows. These changes in water quantity could alter the physical characteristics of stream channels and affect the speed of water movement. Changes would persist until the site was revegetated.

Impacts by Herbicide

The 2007 PEIS discusses the impacts to water resources for each of the 18 currently approved herbicides (USDOI BLM 2007a:4-29 to 4-34). The impacts of the three new herbicides are discussed in the following sections.

Aminopyralid

Aminopyralid is moderately persistent and has high mobility in most soils because of its low soil adsorption values (Table 4-5; USEPA 2005c). Therefore, it is transported to surface water and groundwater. Breakdown by microbes in soil is the primary form of dissipation. Aminopyralid's mobility and high water solubility suggest that the herbicide is prone to leaching (Lindenmeyer 2012). However, in past studies, leaching of aminopyralid has not been documented at levels below 30 centimeters (USEPA 2005b).

In water, aminopyralid is stable and does not readily react with water, but is broken down by sunlight. The half-life by photolysis is very short, at 0.6 days (USEPA 2005b). Therefore, it is expected that aminopyralid rapidly dissipates in clear, shallow surface water (USEPA 2005c). Within fast-moving water it rapidly dissipates through mixing. The major metabolic products of photolysis in water are oxamic acid and malonamic acid, neither of which would form in large concentrations, or are of concern from a toxicity standpoint (USEPA 2005b).

Once aminopyralid leaches down to anaerobic soil depths, degradation is likely to slow, which could be a factor in groundwater contamination (USEPA 2005c). At one study in Montana, aminopyralid was detected in groundwater in one of 23 wells (Schmidt and Mulder 2009), indicating that there is some risk of groundwater contamination. It is expected that concentrations of aminopyralid in groundwater would be greatest in areas with a high water table and when rainfall happens immediately after application (USEPA 2005c).

Neither aminopyralid nor its major metabolic products are included on the USEPA's list of drinking water contaminants (USEPA 2013b).

Because of its moderate persistence, high mobility, and low soil adsorption, aminopyralid has a high potential for surface water runoff. A Forest Service risk assessment for this active ingredient determined that in areas with high annual rainfall virtually all of the aminopyralid applied to a site could be transported

offsite in surface runoff (Syracuse Environmental Research Associates, Inc. 2007).

Fluroxypyr

Based on soil adsorption characteristics, fluroxypyr is expected to have a high mobility in soil. However, it has a low potential for movement to groundwater because it is rapidly broken down by microbes in the soil (soil half-life is 1 to 3 weeks; California Department of Pesticide Regulation 2005; U.S. National Library of Medicine 2011). In field studies submitted to the USEPA, fluroxypyr was generally not found below a soil depth of 6 inches (USEPA 1998a), although this may vary depending on soil type and amount of rainfall. In sandy soils, the potential to leach to groundwater is much higher, and has been identified as a concern (NYSDEC 2006). Factors that influence the rate of fluroxypyr degradation in soils include soil microbes, organic matter, temperature, and soil moisture (Tao and Yang 2011).

In water, fluroxypyr does not readily break down by photolysis, but is biodegraded by microorganisms in the water and undergoes hydrolysis under certain conditions. The aquatic half-life is fairly short, at 5 to 14 days (U.S. National Library of Medicine 2011).

The two major biotransformation products of fluroxypyr (a pyridine and a methoxypyridine), may be more persistent in water than fluroxypyr (Health Canada 2012). Studies of fluroxypyr in Sweden detected both fluroxypyr and pyridine in the groundwater beneath a railway treatment site (Cederlund et al. 2012).

Neither fluroxypyr nor its two major biotransformation products are included on the USEPA's list of drinking water contaminants (USEPA 2013b).

Because of its quick rate of breakdown, fluroxypyr is expected to have a low risk of surface water runoff. A Forest Service risk assessment for this active ingredient determined that up to 10 percent of applied herbicide would leave a site in surface water runoff in areas with clay soils and high rates of rainfall. For most other soils, about half this amount was expected to runoff, with virtually no run off from predominantly sandy soils (Syracuse Environmental Research Associates, Inc. 2009).

Rimsulfuron

As discussed in the soil resources section, rimsulfuron is unstable in soil, and therefore likely has a low risk of leaching to groundwater. The pH of the site conditions are likely a factor, with rimsulfuron less mobile in acidic conditions. Its metabolites may have a greater likelihood of contaminating groundwater, particularly the second metabolite, which is not readily degraded (Metzger et al. 1998).

There is little available information about rimsulfuron and its metabolites in terms of groundwater and surface water contamination. One study in sandy soils found no rimsulfuron in groundwater following an herbicide application, but did find the first metabolite in the soil water at a depth of 1 meter, for as long as 3 years, in concentrations unsafe for drinking water. Concentrations of the second metabolite were much lower (Rosenbom et al. 2010).

In aquatic systems, rimsulfuron is broken down via biodegradation and photodegradation. The biodegradation half-life is estimated at 10 days under aerobic conditions (NYSDEC 2009).

Neither rimsulfuron nor its two metabolites are included on the USEPA's list of drinking water contaminants (USEPA 2013b).

Given its fairly rapid dissipation rate in the soil, rimsulfuron has a low risk of surface runoff. If a rain event were to occur a week after application of rimsulfuron, only a very small portion of the active ingredient would be available for movement (NYSDEC 1997).

Impacts by Alternative

Under all alternatives, one goal of herbicide treatments would be to reduce noxious weeds and other invasive species to improve watershed condition and protect watersheds from wildfire. The BLM would also strive to increase the number/acreage/miles of properly functioning wetland/riparian areas to benefit water quality. Work to restore degraded habitats and native plant communities would be expected to benefit water resources under all alternatives.

By minimizing fire risk through management of cheatgrass and other winter annual grasses, the risk of post-fire sedimentation into aquatic habitats would also be minimized. When soils are carried into lakes and streams, water quality diminishes as a function of increased sedimentation and turbidity (USDOI BLM 2000). Additionally, some invasive vegetation, such as pinyon and juniper, reduces water availability for native species (USDOI BLM 1999). Furthermore, annual

grasses reduce the overall vegetative cover in a watershed, relative to native grasses, which leads to reduced infiltration, increased runoff, and loss of soil moisture. Eventually, soils are transported to streams and other aquatic bodies, increasing sedimentation and reducing water quality. The benefits associated with herbicide treatments that reduce the cover of non-native invasive species would occur under all alternatives.

Alternative A – Continue Present Herbicide Use (No Action Alternative)

Under the No Action Alternative, the BLM would continue its vegetation management programs using the current list of 18 herbicides. The use of individual herbicides may vary somewhat from historic usage based on identified future projects, as summarized in Table 2-4. The estimated total land area treated with herbicides would remain at 932,000 acres annually. The impacts under this alternative were summarized in the 2007 PEIS (USDOI BLM 2007a:4-35). In general, herbicide treatments would provide benefits to water resources by managing invasive species that damage watersheds.

Approved aquatic herbicides would continue to be applied directly to water to control aquatic species. The 2007 PEIS identified concerns associated with use of the known groundwater contaminants 2,4-D, bromacil, dicamba, diquat, diuron, hexazinone, and picloram. Other herbicides were identified as having the potential to leach to groundwater or be carried to surface water in stormwater runoff.

Under this alternative, use of clopyralid, glyphosate, imazapic, tebuthiuron, and triclopyr would comprise herbicide treatments on approximately 73 percent of all acres treated. Based on information in the 2007 PEIS, glyphosate is a known groundwater contaminant, persists in aquatic environments, and may stimulate algal growth in low concentrations. There are fewer concerns about the other herbicides in this list, although imazapic is believed to be a groundwater contaminant, and tebuthiuron has been detected in surface water. Concerns associated with use of these herbicides would continue under this alternative. The impact summary for this alternative in the 2007 PEIS was that there would be some risks to water resources from herbicide treatments, as well as benefits associated with watershed improvements.

Alternative B –Allow For Use of Three New Herbicides in 17 Western States (Preferred Alternative)

Under this alternative, the extent of herbicide treatments would be the same as under the No Action Alternative, with associated risks to water resources over roughly the same geographic area. However, the suite of herbicides used would be slightly different. Aminopyralid, fluroxypyr, and rimsulfuron would be added to the list of herbicides used to treat vegetation. Therefore, the number of chemicals with the potential to impact water resources would increase under this alternative. None of the new herbicides are groundwater or drinking water contaminants of concern, although the potential for such contamination by these herbicides and their degradation products exists.

Use of some previously-approved herbicides would decrease under this alternatives, primarily that of glyphosate, imazapic, and picloram. The use of the known groundwater and drinking water contaminants, glyphosate and picloram, would decrease by 7 percent and 4 percent, respectively, meaning that 11 percent fewer acres would be treated with these herbicides than under the No Action Alternative. Use of imazapic, a possible groundwater contaminant, would decrease by 10 percent. Use of all other currently approved herbicides would be the same as or within 3 percent of the current level of usage.

Under this alternative, use of fluroxypyr would be low (approximately 1 percent of all acres treated), but use of aminopyralid and rimsulfuron would account for 26 percent of all acres treated. As discussed in the Impacts by Herbicide section, there may be some risk of groundwater contamination associated with aminopyralid and the degradation products of rimsulfuron. Based on the available information, these risks are likely lower than those associated with glyphosate and picloram, indicating that effects to water resources may be reduced under this alternative, relative to the No Action Alternative.

None of the new herbicides would be used to manage aquatic vegetation. Therefore, the level of benefit to water resources from control of unwanted aquatic vegetation, such as Eurasian watermilfoil, would be the same as under the other alternatives. If availability of the new herbicides were to increase the efficacy of the BLM's vegetation treatment programs, resulting in an improvement in watershed condition, water resources could receive a higher degree of benefit from treatment programs than under the No Action Alternative.

Alternative C – No Aerial Application of New Herbicides

Under this alternative, total herbicide use would be the same as under the other alternatives (932,000 acres), but aerial applications of aminopyralid, fluroxypyr, and rimsulfuron would not be allowed. The number of chemicals with the potential to impact water resources would be the same as under the Preferred Alternative. However, use of glyphosate, picloram, and imazapic would decrease by 9 percent, which is less of a decrease than under the Preferred Alternative. Aminopyralid and fluroxypyr would only be used on 9 percent of treatment acres. Therefore, reduction in risks to water resources through a reduction in use of known contaminants would be less under this alternative than under the Preferred Alternative.

Watershed-level benefits to water resources could be slightly greater than under the No Action Alternative, and slightly less than under the Preferred Alternative. Not being able to apply the new herbicides aerially would limit their usefulness in certain situations, although these needs would continue to be met through aerial applications of currently approved herbicides.

Alternative D – No Use of New Acetolactate Synthase-inhibiting Active Ingredients (No Rimsulfuron)

Under Alternative D, total herbicide use would be the same as under the other alternatives. However, without the option of rimsulfuron, the percent of land area treated with the new herbicides would be the lowest of all the action alternatives, at 11 percent (10 percent for aminopyralid and 1 percent for fluroxypyr). This alternative is the closest to the No Action Alternative in terms of how much of each of the currently available herbicides would be used. Most of the currently available herbicides would be used at levels similar to those under the No Action Alternative, with the biggest reductions in use of picloram (4 percent reduction) and metsulfuron methyl (3 percent reduction). There could be some reduced risks to water quality as a result of a decrease in the use of picloram, but glyphosate would continue to be used at nearly the same level as under the No Action Alternative.

The number of chemicals with the potential to impact water resources would be greater than under the No Action Alternative, but less than under the Preferred Alternative and Alternative C.

Watershed-level benefits would be similar to those under the No Action Alternative.

Mitigation for Herbicide Treatment Impacts

No new mitigation measures, or measures specific to the three new herbicides, are proposed for water resources. The BLM's SOPs to protect water resources would continue to be implemented. These include procedures designed to prevent accidental spills of herbicides into aquatic habitats.

Wetland and Riparian Areas

Introduction

Herbicide treatments have the potential to alter vegetation, hydrology, or soils in wetland and riparian areas, affecting the functions of these areas. However, herbicide treatments that control non-native species in wetland and riparian habitats would be beneficial. Invasive plant species are one cause of degradation in the function of wetland and riparian areas.

Scoping Comments and Other Issues Evaluated in the Assessment

Scoping comments pertinent to wetland and riparian areas included those addressing soil resources, water resources and quality, and vegetation (see the Soil Resources, Water Resources and Quality, and Vegetation sections).

A few comments were specific to wetlands and riparian areas, including one that noted the importance of using aminopyralid in riparian areas to control invasive plants, and one concerned with residual effects of aminopyralid in vegetation in wetland and riparian areas.

Factors that Influence the Fate, Transport, and Persistence of Herbicides in Wetland and Riparian Areas

If applied directly to wetlands and riparian areas, herbicides dissipate by transport through water or wind, through chemical or biological degradation, or through adsorption and immobilization in soils. Wetlands and riparian areas adjacent to herbicide treatment sites can help filter herbicides from runoff through physical,

chemical, and biological processes (Mitch and Gosselink 2000). Factors that influence herbicide fate in wetlands include the amount and type of vegetation, the amount of organic matter in the soil, oxygen availability, and populations of soil microbes (Stoeckel et al. 1997).

Saturated wetland soils have chemical and biological characteristics that are different from well-drained upland soils, including oxidation-reduction status, pH, and organic content. The characteristics of wetland soils affect their capacity to adsorb, transport, and transform herbicides. The fate of herbicides in wetland soils is dependent on the duration of saturation, soil temperature, the kind and amount of organic matter, and the nature and content of reactive chemicals present in the soil.

The rate of breakdown in anaerobic systems can be estimated by the measured anaerobic half-life (Table 4-6). With the exception of fluroxypyr, anaerobic degradation processes are typically slower than the degradation processes in well-drained soils where oxygen is present. However, the soil type and other environmental conditions are also important factors.

TABLE 4-6
Anaerobic Half-life in Soil for Herbicides Analyzed in this PEIS

Herbicide	Anaerobic Soil Half-life (days)	Aerobic Soil Half-life (days)
Aminopyralid	462-990	32-533
Fluroxypyr	3.5-14	7-21
Rimsulfuron	18	5 to 40
Sources: USEPA 2005c, NYSDEC 2009, U.S. National Library of Medicine 2011.		

Methodology for Assessing Impacts to Wetland and Riparian Areas

The BLM reviewed the literature and findings from ERAs to assess the impacts to aquatic plant species from the use of herbicides (AECOM 2014a-c). The ERA methods and results for aquatic and terrestrial vegetation are summarized in the Vegetation section of this chapter. Methods used by the BLM are presented in detail in the *Vegetation Treatments Programmatic EIS Ecological Risk Assessment Protocol* (ENSR 2004).

The analysis of impacts to wetland and riparian areas assumes that the BLM would follow applicable SOPs identified in the 2007 PEIS:

- Survey for special status aquatic and riparian plant species before treating an area, at a time when the plants can be identified.
- Use drift reduction agents to reduce the risk of drift hazard.
- Use a selective herbicide and a wick or backpack sprayer.
- Use an appropriate herbicide-free buffer zone for herbicides not labeled for aquatic use. This information is discussed in the ERA guidance provided in the Vegetation section of this chapter. Minimum buffer widths for herbicides not labeled for aquatic use are 100 feet for aerial, 25 feet for vehicle, and 10 feet for hand applications (larger buffers may be required if special status species are present).

Other SOPs would help minimize the risk of a spill into wetland habitats, including preparing a spill contingency plan in advance of treatments, mixing and loading herbicide products in an area where an accidental spill would not reach a water body, not rinsing spray tanks in or near water bodies, following product labels for use and storage, and having licensed applicators apply the herbicides.

Summary of Herbicide Impacts

None of the three active ingredients proposed for use are currently approved for direct aquatic applications. Therefore, the BLM's minimum buffers would apply, unless ERAs indicate larger buffers are warranted, or project-specific NEPA analysis indicates that a smaller buffer is appropriate. Aminopyralid, fluroxypyr, and rimsulfuron can be applied in dry riparian areas, non-irrigation ditch banks, seasonally dry wetlands, and transitional areas between upland and lowland sites. Additionally, if aminopyralid receives an aquatic registration in the future, the buffers associated with its use near aquatic habitats could be reduced.

Based on the likely usage of the three active ingredients, wide-scale removal of riparian vegetation would not occur. Fluroxypyr and rimsulfuron would not typically be used near water, except possibly for spot treatments of certain target species. However, aminopyralid would be used in riparian treatments for selective removal of certain species (e.g., knapweeds), although extensive removal of riparian vegetation would be unlikely. If aminopyralid receives an aquatic registration in the

future, it could be used to target wetland and riparian species, such as purple loosestrife, Japanese knotweed, and saltcedar. In riparian areas and wetlands, aminopyralid would provide an alternative to glyphosate, which is less selective and more likely to result in removal of non-target riparian and wetland vegetation.

A general discussion of impacts to wetlands and riparian areas from use of herbicides to control aquatic and riparian vegetation is provided in the 2007 PEIS (USDOI BLM 2007a:4-37 to 4-38). Herbicide treatments can improve habitat quality for fish and wildlife, improve hydrologic function, and reduce soil erosion. Herbicide treatments would focus on non-native species that displace native vegetation and that alter wildlife habitats, hydrology and soil conditions. Many of the species targeted for control (such as purple loosestrife, reed canarygrass, and saltcedar) form dense monocultures that shade out native species and reduce wetland functions. Management of these species would be expected to increase the functions and values of treated wetlands and riparian areas.

While loss of vegetation could lead to short-term impacts such as increased sedimentation and nutrient loading, and alteration of vegetation, water temperature, and hydrologic conditions, it is expected that these short-term impacts would be minimal given that extensive removal of riparian vegetation would be unlikely.

A general discussion of the impacts to wetlands and riparian areas from the use of herbicides in upland areas is provided in the 2007 PEIS (USDOI 2007a:4-40). Non-target wetland and riparian areas could be exposed to herbicides transported from upland areas via a variety of methods. The primary potential impacts would be loss of non-target native vegetation and contamination of water or soil, particularly as a result of an accidental spill.

Aminopyralid

As discussed previously, aminopyralid could be used in dry wetlands and riparian areas. Therefore, any herbicide that remains adsorbed to soil particles could be released into the water if these areas become flooded or saturated following the treatments. Additionally, if aminopyralid receives an aquatic registration, it could be used in saturated conditions, and could enter the water directly as a result of incidental overspray.

Aminopyralid does not have activity on submerged aquatic species, such as watermilfoil and water-thyme, and would not be applied directly to the water column to treat unwanted aquatic vegetation. However, it may be effective at controlling riparian invasives. Field research trials support use of aminopyralid to manage emerged shoreline invasive species (e.g., purple loosestrife, Japanese knotweed, and invasive thistle species; Peterson et al. 2013).

Aminopyralid is effective against many invasive herbaceous broadleaf weeds, and may offer improvements in control of Russian olive and saltcedar. One study found that adding aminopyralid to triclopyr increased its control of these species without injuring desirable understory grass vegetation (Sluegh et al. 2011).

Aminopyralid has a photodegradation half-life of 0.6 days in aquatic systems (USEPA 2005c). In anaerobic systems, however, the active ingredient is persistent, with a half-life between 462 and 990 days (USEPA 2005c). The half-life in sediment is 999 days (Yoder and Smith 2002).

As described in the ERA for aminopyralid, non-target aquatic plants are not at risk for adverse effects from exposure to aminopyralid, even under direct spray and worst-case spill scenarios. However, non-aquatic plants (including riparian species and emergent wetland plants) would be at risk for adverse effects if a broadcast spray treatment were to occur near wetland and riparian habitats. Use of adequate buffers would be required to prevent adverse effects to sensitive riparian and wetland habitats under broadcast spray scenarios. These buffers are discussed in more detail in the Vegetation section (see Table 4-8).

Fluroxypyr

As discussed previously, fluroxypyr would have minimal use in wetland and riparian habitats, except for spot treatments of certain target species. It is not approved for use in aquatic habitats or wetlands when water is present. Therefore the amount of this active ingredient that is likely to be released to wetland and riparian areas under normal application scenarios is very small. Accidental spills or movement from adjacent upland areas could result in more of the active ingredient entering wetland or riparian habitats.

Fluroxypyr is short-lived in anaerobic environments. In anaerobic soil the half-life is 14 days or less (National Library of Medicine 2011). In anaerobic aquatic

habitats, the half-life is 8 days (USEPA 1998a). The breakdown products may persist for longer.

As described in the ERA for fluroxypyr, non-target aquatic plants are not at risk for adverse effects from fluroxypyr under direct spray or surface runoff scenarios. However, they would likely be harmed by an accidental spill of fluroxypyr into a pond or stream in which they occur. The risks of such a spill occurring would be reduced by applicable SOPs, as discussed earlier in this Wetland and Riparian Areas section. Non-aquatic plant species in wetlands and riparian areas would be at risk for adverse effects from spray drift at nearby upland habitats. Suitable buffers would be required to prevent adverse effects to non-target plants in sensitive riparian and wetland habitats. See Table 4-8 and the Vegetation section for more information on buffers.

Algal growth may be stimulated at low fluroxypyr concentrations but depressed at higher concentrations (Zhang et al. 2011).

Rimsulfuron

As discussed previously, rimsulfuron is not likely to be used much in or near wetland and riparian areas, except for spot treatments of certain target species. Similar to fluroxypyr, only small amounts of this chemical are likely to enter wetland and riparian areas under normal application scenarios, although larger amounts could enter these habitats as a result of an accidental spill or movement from an adjacent treatment site.

Rimsulfuron has a high rate of soil adsorption in soils with high organic content (Metzger et al. 1998). However, it is quickly degraded under anaerobic conditions. In anaerobic soil the half-life is approximately 18 days. In anaerobic aquatic habitats, the half-life is less than 2 days (NYSDEC 2009). Breakdown products may persist for longer.

According to the ERA, rimsulfuron poses a risk to non-target aquatic plants under direct spray, accidental spill, spray drift, and certain surface runoff scenarios. Risks associated with surface runoff would be limited to aquatic plants in ponds, and would be greatest in areas with 50 inches of precipitation or more per year. Non-aquatic plants, such as riparian and emergent wetland species would also be at risk for adverse effects from treatments in nearby upland habitats. These findings indicate that buffers are needed between treatment sites and wetlands/riparian areas to protect vegetation from unintended harm. These buffers are discussed in more detail in the Vegetation section and Table 4-8.

Impacts by Alternative

Alternative A – Continue Present Herbicide Use (No Action Alternative)

Under the No Action Alternative, the BLM would continue its ongoing vegetation management programs in 17 western states, and would be able to use the current list of 18 approved herbicides for treatments. Impacts under this alternative would correspond to those discussed under the Preferred Alternative in the 2007 PEIS (USDOI BLM 2007a:4-42). The total area receiving herbicide treatments would be 932,000 acres annually, of which approximately 10,000 acres would consist of aquatic and riparian habitat. Herbicides used to manage aquatic and riparian vegetation under this alternative could include 2,4-D, diquat, fluridone, glyphosate, and imazapyr, which are registered for aquatic uses; and dicamba, tebuthiuron, and triclopyr in riparian areas where contact with water can be avoided.

Use of the currently approved herbicides would be associated with both beneficial and adverse effects to wetlands and riparian areas. There would be some risk for contamination of water and/or soils in these habitats as a result of herbicide applications or spills, as well as risks to non-target plant species from exposure to herbicides via various pathways.

Herbicide treatments that target invasive riparian and wetland plant species would be expected to benefit these habitats by promoting the reestablishment of native species and improving the functions provided by the targeted wetlands and riparian areas. The BLM would be able to control targeted invasive species (such as Eurasian water milfoil, water-thyme, purple loosestrife, and saltcedar) with the suite of herbicides available for use.

Alternative B – Allow for Use of Three New Herbicides in 17 Western States (Preferred Alternative)

Under this alternative, the estimated area of wetland and riparian areas receiving herbicide treatments annually would be the same as under the No Action Alternative and the other action alternatives. However, aminopyralid, fluroxypyr, and rimsulfuron would be added to the list of herbicides available for use. Because none of the new active ingredients would be registered for direct applications to the water column, they would

not be used to control invasive aquatic species. 2,4-D, diquat, fluridone, glyphosate, and imazapyr would continue to be used for these aquatic applications.

While fluroxypyr and rimsulfuron would receive minor use in wetland and riparian habitats, aminopyralid would be an important component of riparian and wetland treatments, particularly if it receives an aquatic registration allowing incidental overspray into wetlands and aquatic habitats. The BLM has identified aminopyralid as a good alternative to glyphosate that is more selective and therefore less likely to harm target vegetation, and may be less of a concern in terms of persistence in groundwater and aquatic habitats (see the Water Resources and Quality section). However, aminopyralid persists in anaerobic, wetland soils for much longer than glyphosate (462 to 990 days, versus 12 to 70 days for glyphosate). Therefore, use of aminopyralid in and near wetland habitats may have a greater impact than glyphosate from an environmental persistence standpoint. Under this alternative, it is expected that use of glyphosate would be reduced, relative to the No Action Alternative. It is likely that the BLM would use aminopyralid to target knapweeds in riparian areas, as well as for other broadleaved invasive species.

The addition of fluroxypyr and rimsulfuron may also reduce the usage of some other herbicides in wetland and riparian areas, but not to a substantial degree.

Alternative C – No Aerial Application of New Herbicides

Alternative C is similar to the Preferred Alternative in that the same herbicides would be available for use, and the total area of wetland and riparian areas treated would be approximately 10,000 acres. As discussed in the 2007 PEIS (USDOI BLM 2007a:4-43), nearly all of the herbicide treatments in wetland and riparian areas are done using ground-based methods. Additionally, aerial applications of upland areas would be completed using the currently approved herbicides, so risks to wetlands and riparian areas from spray drift would be much the same as under the other alternatives, although different herbicides than under Alternatives B and D may be used.

Benefits and risks to wetland and riparian areas would be much the same as under the Preferred Alternative. For ground-based treatments in wetlands and riparian areas, aminopyralid would likely be used instead of glyphosate in certain situations.

Alternative D – No Use of New Acetolactate Synthase-inhibiting Active Ingredients (No Rimsulfuron)

Effects to wetlands and riparian areas under Alternative D would be much the same as those under the Preferred Alternative. Rimsulfuron would not be available for use under Alternative D. However, since rimsulfuron would receive minimal use near wetlands and in riparian areas, there would be little difference in herbicide usage in these areas relative to the other alternatives. Aminopyralid would be used instead of glyphosate for certain treatments in and near wetlands and riparian areas, similar to the other action alternatives. Benefits and risks to wetland and riparian areas would also be much the same as under the other action alternatives.

Mitigation for Herbicide Treatment Impacts

No mitigation measures have been developed that are specific to wetlands and riparian areas. The BLM's SOPs to protect water resources and vegetation would also help protect riparian and wetland habitats. Additionally, mitigation measures for vegetation, specified in the next section, would help protect riparian and wetland habitats. These include utilizing adequate buffer zones between sensitive non-target vegetation and herbicide treatment areas, which in many cases would be applicable to riparian and wetland vegetation.

Vegetation

Introduction

The present-day composition and distribution of native plant communities in the western U.S. are influenced by many factors, including physical factors (e.g., climate, drought, wind, geology, topography, elevation, latitude, slope, and exposure), natural disturbance (e.g., insects, disease, fire, and wildlife browsing), and human-management patterns (e.g., domestic livestock grazing). Non-native plant species have caused a decline in the extent of some native plant communities in each of the western states. The rapid expansion of invasive plant species across public lands continues to be a primary cause of ecosystem degradation, and control of these species is one of the greatest challenges in ecosystem management. The recent increase in wildfires has been influenced by changes in vegetation on public lands over the past 100 years, which have resulted in increases in hazardous fuels. Cheatgrass, which is

widespread on public lands, burns more frequently than native vegetation types and is disproportionately represented in the largest fires, indicating that invasion of this species has substantially altered fire regimes (Balch et al. 2013).

Scoping Comments and Other Issues Evaluated in the Assessment

Numerous scoping comments received by the BLM pertain to vegetation, addressing both the beneficial effects associated with use of the three new herbicides to control weeds, and the potential adverse effects to non-target vegetation. Most comments discuss the efficacy and low impact of the herbicides proposed for use, and their low impact to native plant species relative to other herbicides that are currently being used by the BLM. Specifically, numerous comments identified the efficacy of rimsulfuron at controlling cheatgrass and medusahead rye, the efficacy of aminopyralid as a control of knapweed, thistles, and rush skeletonweed, and the efficacy of fluroxypyr on kochia.

Several comments were concerned about the effects to non-target vegetation from residual aminopyralid or fluroxypyr in manure and compost and other plant materials. One comment addressed the importance of reseeding of desirable species after treatments to promote recovery of native plant communities following herbicide treatments.

Standard Operating Procedures

Risks to non-target plants associated with herbicide use would continue to be minimized by following the SOPs listed in the 2007 PEIS, which are general procedures designed by the BLM to reduce potential unintended impacts to non-target vegetation from herbicide treatments. Examples of pertinent SOPs (with slight modifications since 2007) include the following:

- Conduct pre-treatment surveys for sensitive habitat and special status species within or adjacent to proposed treatment areas, at a time when the plants can be found.
- Consider site characteristics, environmental conditions, and application equipment in order to minimize damage to non-target vegetation.
- Use drift reduction agents, as appropriate, to reduce the drift hazard to non-target species, and colorants to obtain a uniform coverage.
- Turn off aerially applied treatments at the completion of spray runs and during turns to start another spray run.
- Refer to the herbicide label when planning revegetation to ensure that subsequent vegetation will not be injured following application of the herbicide.

Additionally, the BLM would follow the mitigation measures that were adopted in the 2007 ROD (USDOI BLM 2007b: Table 2) for vegetation treatments involving the 18 currently approved herbicides. These mitigation measures include establishing herbicide-specific buffer zones, limiting aerial applications of certain active ingredients, and minimizing the use of terrestrial herbicides in watersheds with downgradient ponds and streams if potential impacts to aquatic plants are identified. Some of these measures would apply to treatments involving the three new active ingredients, including tank mixes that include the currently approved herbicides for which specific mitigation measures have been developed.

These procedures would minimize impacts to plants and ecosystems on public lands from use of the new active ingredients to the extent practical. Long-term benefits to native plant communities from management of invasive plants would likely continue to outweigh any short-term negative impacts to native plants associated with herbicide use.

Impacts Assessment Methodology

The method of assessing impacts to non-target vegetation from the three new herbicides was the same as the method described in the 2007 PEIS (USDOI BLM 2007a:4-45 to 4-46; Appendix C) for herbicides with BLM ERAs. A brief overview of the ERA process is presented here. Additionally, information about likely future herbicide treatments, provided by local field offices for development of the 2007 PEIS, was assumed to be applicable to the alternatives in this PEIS. This information includes the location, application method, vegetation type, and size of the treatment (in acres).

Risk Assessment Methodology

Risk assessments evaluated the risks to terrestrial and aquatic non-target plants from herbicide exposure. Risk assessments consider assessment endpoints and associated measures of effect. The assessment endpoint is an expression of the value that is to be protected. In the case of non-target plants, assessment endpoints

include mortality and negative impacts on growth, reproduction, or other ecologically important sublethal processes. For the most part, assessment endpoints reflect direct effects of the herbicide, although indirect effects were also considered.

Measures of effect are measurable changes in an attribute of an assessment endpoint (or its surrogate) in response to a stressor to which it is exposed (USEPA 1998b). For the ERAs, these measures generally consisted of acute and chronic toxicity data (from pesticide registration documents and from the available scientific literature) for the most appropriate surrogate species.

Because the BLM applies herbicides in a variety of sites using a variety of application methods (e.g., via aircraft, vehicle, and backpack), the following exposure scenarios were considered to assess the potential ecological impacts of herbicides under a variety of uses and conditions:

- Direct spray of the receptor.
- Off-site drift of spray to terrestrial areas and water bodies.
- Surface runoff from the application area to off-site soils or water bodies.
- Wind erosion resulting in deposition of contaminated dust.
- Accidental spills to water bodies.

The AgDRIFT computer model was used to estimate off-site herbicide transport due to spray drift. The Groundwater Loading Effects of Agricultural Management Systems (GLEAMS) computer model was used to estimate off-site transport of herbicide in surface runoff and root zone groundwater transport. The AERMOD and CALPUFF computer models were used to predict the transport and deposition of herbicides adsorbed (i.e., reversibly or temporarily attached) to wind-blown dust. Each model simulation was conservatively approached with the intent of predicting the maximum potential herbicide concentration that could result from the given exposure scenario.

In order to address potential risks to plant receptors, Risk Quotients (RQs) were calculated. To help translate RQs into estimates of risk, the calculated RQs were compared with Levels of Concern (LOCs) used by the USEPA in screening the potential risk of herbicides. For plants, distinct USEPA LOCs are currently defined for the following risk categories:

- Acute high risk – the potential for acute risk is high.
- Acute endangered species – threatened, endangered, and proposed species may be adversely affected.

For the analysis presented in this PEIS, the LOC for acute high risk (1) was used for typical terrestrial and aquatic plant species. Wherever the RQ exceeded the LOCs, it was assumed that acute adverse effects to non-target plant species could potentially occur under that exposure scenario. The methodology for determining risks to special status plant species is discussed later in this section, under the Special Status Plant Species subheading.

Impacts of Herbicide Treatments

Under all alternatives, treatments involving the new herbicides would be one component of the BLM's larger vegetation management programs, which have been discussed in more detail in the 2007 PEIS and PER. As discussed in the 2007 PEIS (UDSI BLM 2007a:4-47), the effectiveness of herbicide treatments in managing target plants and the extent of disturbance to plant communities varies by the herbicide selectivity, the extent and density of the infestation, the size of the application area, and the application method (e.g., aerial vs. ground). Individual plant sensitivities, physical features (e.g., soil type and slope), and weather conditions (e.g., temperature, humidity, and wind speed) at the time of application also factor into the success of a treatment. Additionally, other treatments or herbicides used in conjunction with treatments involving aminopyralid, fluroxypyr, and rimsulfuron would influence the effectiveness of the overall treatment.

Herbicide treatments would likely affect plant species composition of an area and might affect plant species diversity. The discussions in this section focus on the impacts of the three new herbicides on vegetation (both target and non-target species). General discussions about the impacts of herbicide treatments on vegetation can be found in the 2007 PEIS (USDOI BLM 2007a:4-47 to 4-48). For treatments involving one or more of the three new herbicides, active ingredients that adversely affect plants could come into contact with vegetation via direct spraying, drift, runoff, wind transport, or accidental spills. Potential impacts include mortality,

reduced productivity, and abnormal growth. These exposure pathways and associated risks to non-target plants were evaluated in risk assessments for the three herbicides (AECOM 2014a-c).

Impacts of Aminopyralid

Target Plants

Aminopyralid is a post-emergence, selective herbicide that is used to manage invasive annual, biennial, and perennial species. It is a plant growth regulator that binds to receptor sites normally used by the plant's natural growth hormones, causing death of the plant. Anecdotal evidence and controlled studies of aminopyralid have found it to be effective at controlling yellow starthistle, Russian knapweed, various thistles, rush skeletonweed, and other invasive plants of rangelands (DiTomaso and Kyser 2006; Enloe et al. 2008; Bell et al. 2012). Other species controlled by aminopyralid include, oxeye daisy, Mediterranean sage, and Japanese and other large knotweeds (DiTomaso et al. 2013). The BLM has identified this herbicide for its activity on difficult-to-control species in rangelands, among other uses. It is an alternative to other growth regulator herbicides that are commonly used on broadleaf weeds, such as picloram, clopyralid, 2,4-D, and dicamba. Studies have also found aminopyralid to be as or more effective than the currently approved growth regulator herbicides at lower application rates (Enloe et al. 2007, 2008; Bell et al. 2012). Aminopyralid has a higher specific activity than other growth regulator herbicides, so less of it needs to be used to achieve the same result (Iowa State University 2006). In mixtures with other active ingredients, it can be used on hard-to-control species like poison hemlock and catsears (DiTomaso et al. 2013).

There is some evidence that aminopyralid may be effective against certain annual grasses when applied at higher application rates pre- or early post-emergence (DiTomaso 2012). At sites representative of annual grasslands in California, it has been shown to control medusahead rye and result in increased cover of more desirable annual forage species, and may also have utility in suppressing cheatgrass (DiTomaso 2012). Additionally, aminopyralid may have a sterilizing effect on annual grasses, and appears to reduce seed production in cheatgrass (Rinella et al. 2013).

Non-Target Plants

Because aminopyralid is used to manage weedy broadleaf species, it poses a risk to non-target native forbs and other desirable species in treatment areas. Generally speaking, it is a selective herbicide, falling between picloram and clopyralid in terms of selectivity (Iowa State University 2006). Studies with aminopyralid indicate that some native species are more tolerant to aminopyralid than others (Mikkelson and Lym 2013), indicating that the native species composition of treatment sites could be altered by the use of aminopyralid. Based on its documented control of invasive plants, key flowering plant families that are affected by aminopyralid include the Asteraceae (aster), Fabaceae (legume), and Polygonaceae (buckwheat) families. Additionally, the timing of a treatment may influence which native species will be most tolerant to aminopyralid (Halstvedt et al. 2011). In general, this herbicide is likely to select for perennial grass species and more resistant forb species. However, there is also evidence that use of aminopyralid causes an overall increase in the relative cover and dominance of native species (Green et al. 2011). Reduction in cover of non-native species and an increase in native species would have a long-term beneficial effect at treatment sites.

One study documented adverse effects to forest communities from use of aminopyralid. Aminopyralid treatments in ponderosa pine stands (trees 5 to 10 years old, at higher rates than those proposed by the BLM) can result in injury to ponderosa pine trees, leading to decreased canopy volume and variable growth patterns (Wallace et al. 2012).

As stated on the herbicide label, aminopyralid may impact non-target broadleaf plants indirectly if urine or manure from animals that graze on treated pasture within 3 days of the herbicide application comes into contact with these plants (Iowa State University 2006). Aminopyralid is persistent in plant materials, and may remain in undigested remains of treated vegetation for more than 2 years (Oregon State University 2009, Dow AgroSciences 2014). This persistence in plant materials is generally a concern for crops and other plantings that are treated with compost that contains plant residues or hay or straw from treated areas. However, it is possible that some localized impacts to non-target native plants could occur if livestock or wildlife graze in treated areas and then release their waste materials on desirable broadleaf native species.

The risk assessment for aminopyralid indicates that aminopyralid poses a high risk to non-target plants within the treatment area. As shown in Table 4-7, risks for adverse effects to terrestrial plants would be high if there was direct exposure to aminopyralid as a result of

TABLE 4-7
Risk Categories Used to Describe Typical Herbicide Effects to Vegetation According to Exposure Scenario and Ecological Receptor Group

Application Scenario	Aminopyralid		Fluroxypyr		Rimsulfuron	
	Typ[1]	Max[1]	Typ	Max	Typ	Max
Direct Spray/Spill						
Terrestrial plants	**H**[2] [1:1]	**H** [1:1]	**H** [1:1]	**H** [1:1]	**H** [1:1]	**H** [1:1]
Special status terrestrial plants	**H** [1:1]	**H** [1:1]	**H** [1:1]	**H** [1:1]	**H** [1:1]	**H** [1:1]
Aquatic plants pond	0 [2:2]	0 [4:4]	0 [2:2]	**L** [2:4]	**H** [1:2]	**M** [2:4]
Aquatic plants stream	0 [2:2]	0 [2:2]	0 [2:2]	0 [2:2]	**H** [1:2]	**H** [1:2]
Off-Site Drift						
Terrestrial plants	**L** [10:18]	**L** [10:18]	**L** [11:18]	**L** [11:18]	**L** [9:18]	**L** [9:18]
Special status terrestrial plants	**L** [10:18]	**L** [10:18]	**L** [13:18]	**L** [11:18]	**L** [9:18]	**L** [8:18]
Aquatic plants pond	0 [36:36]	0 [36:36]	0 [36:36]	0 [36:36]	0 [24:36]	0 [23:36]
Aquatic plants stream	0 [36:36]	0 [36:36]	0 [36:36]	0 [36:36]	0 [24:36]	0 [23:36]
Surface Runoff						
Terrestrial plants	0 [42:42]	0 [42:42]	0 [42:42]	0 [42:42]	0 [42:42]	0 [42:42]
Special status terrestrial plants	0 [42:42]	0 [42:42]	0 [42:42]	0 [42:42]	0 [42:42]	0 [42:42]
Aquatic plants pond	0 [84:84]	0 [84:84]	0 [84:84]	0 [84:84]	0 [55:84]	0 [54:84]
Aquatic plants stream	0 [84:84]	0 [84:84]	0 [80:84]	0 [84:84]	0 [84:84]	0 [84:84]
Wind Erosion						
Terrestrial Plants	0 [9:9]	0 [8:9]	0 [9:9]	0 [8:9]	0 [8:9]	0 [8:9]
Special status terrestrial plants	0 [8:9]	0 [8:9]	0 [8:9]	0 [7:9]	0 [8:9]	0 [8:9]

[1] Typ = Typical application rate; and Max = Maximum application rate.
[2] Risk categories: 0 = No risk (majority of RQs < applicable LOC); L = Low risk (majority of RQs 1-10 times the applicable LOC); M = Moderate risk (majority of RQs 10-100 times the applicable LOC); and H = High risk (majority of RQs >100 times the applicable LOC). The Risk Category is based on the risk level of the majority of risk quotients observed in any of the scenarios for a given exposure group and receptor type. For some "no risk" exposure groups, RQs for one or more scenarios exceeded the applicable LOC. The reader should consult the risk tables in Chapter 4 of the ERAs (AECOM 2014a-c) to determine the specific scenarios that result in the displayed level of risk for a given receptor group. The number in brackets represents the number of RQs in the indicated risk category: number of scenarios evaluated.

TABLE 4-8
Buffer Distances to Minimize Risk to Non-target Vegetation from Off-site Drift

Application Scenario	Aminopyralid	Fluroxypyr	Rimsulfuron
Buffer Distance (feet) from Non-Target Terrestrial Plants			
Typical Application Rate			
Plane[1]	1,300 feet	1,200 feet	1,600 feet
Helicopter[1]	1,200 feet	900 feet	1,400 feet
High Boom[2]	200 feet	400 feet	400 feet
Low Boom[2]	25 feet	100 feet	100 feet
Maximum Application Rate			
Plane	1,800 feet	1,500 feet	1,900 feet
Helicopter	1,600 feet	1,400 feet	1,600 feet
High Boom	100 feet	600 feet	700 feet
Low Boom	400 feet	400 feet	400 feet
Buffer Distance (feet) from Terrestrial Threatened, Endangered, and Sensitive Plants			
Typical Application Rate			
Plane	1,800 feet	1,200 feet	1,600 feet
Helicopter	1,600 feet	900 feet	1,400 feet
High Boom	400 feet	400 feet	400 feet
Low Boom	100 feet	100 feet	100 feet
Maximum Application Rate			
Plane	2,000 feet	1,500 feet	1,900 feet
Helicopter	1,700 feet	1,500 feet	1,600 feet
High Boom	600 feet	700 feet	700 feet
Low Boom	400 feet	600 feet	400 feet
Buffer Distance (feet) from Non-Target Aquatic Plants[3]			
Typical Application Rate			
Plane	NA[4]	NA	1,300 feet
Helicopter	NA	NA	1,000 feet
High Boom	NA	NA	200 feet
Low Boom	NA	NA	100 feet
Maximum Application Rate			
Plane	NA	NA	1,400 feet
Helicopter	NA	NA	1,800 feet
High Boom	NA	NA	300 feet
Low Boom	NA	NA	100 feet

[1] Aerial applications over both forested and non-forested land were considered in the ERAs. The largest buffer distances are presented in this table.
[2] High boom is 50 inches above ground and low boom is 20 inches above ground.
[3] Aquatic plants in ponds and streams were considered in ERAs. The largest buffer distances are presented in this table.
[4] NA means that no buffers are required, since direct spray of plants was not predicted to result in adverse effects. However, a direct spray into an aquatic habitat is not an approved use of these herbicides.
Buffer distances are the smallest modeled distance at which no risk was predicted. In some cases, buffer distances were extrapolated if the largest distance modeled still resulted in risk, or interpolated if greater precision was required.

a direct spray (as part of a treatment or accidental) or an accidental spill. Therefore, it is likely that some non-target broadleaf species would be adversely affected if they are present in the treatment area. For non-target aquatic plants, however, ERAs predicted no risk under direct spray or spill scenarios. Aminopyralid is not approved for aquatic uses, but is likely to receive a registration that addresses incidental overspray into aquatic habitats. These risk assessment results indicate that use indicate that use of aminopyralid right up to the water's edge would not harm aquatic plants.

Apart from direct spray scenarios, risks to terrestrial plants would generally be low. Risks associated with off-site drift decrease as the distance from the treatment site increases and the application height gets lower (plane to helicopter to high boom to low boom). The buffer widths shown in Table 4-8 indicate the distances within which adverse effects to non-target terrestrial plants would be expected to occur for the various application scenarios. For aerial applications, buffer distances range from 1,200 to 1,800 feet, depending on the application rate and type of aircraft used. Buffer distances for ground applications are much lower, ranging from 25 to 400 feet.

For surface runoff and root-zone groundwater flow scenarios, no risks to non-target terrestrial or aquatic plants were predicted. The GLEAMS model used to complete this portion of the risk assessments considered a variety of soil types and annual precipitation rates.

For wind erosion scenarios, no risks were predicted for non-target terrestrial plants under the majority of the evaluated conditions. Low risk was predicted for one of the modeled watersheds, with affected plants at a distance of 1.5 kilometers from the original application site. The modeled watershed was Medford, Oregon, a forested site with loam soils, where the presence of tall vegetation caused the model to predict relatively high rates of deposition.

Impacts of Fluroxypyr

Target Plants

Fluroxypyr is a selective, post-emergent herbicide that is used to manage broadleaf species in rangelands and other areas (see Table 2-2). It is in the pyridine class of herbicides, and disrupts plant cell growth by inducing auxin-like responses. It is often used in industrial sites, along roads and railroads, and along ROWs. Based on its documented control of weeds, key flowering plant families that are affected by fluroxypyr include the Asteraceae (aster), and Fabaceae (legume) families.

The BLM has identified the effectiveness of this herbicide on annual and biennial weeds, particularly when tank-mixed with another herbicide such as 2,4-D, dicamba, metsulfuron methyl, or triclopyr. It would be used to manage species such as weedy (annual) kochia, mustards, pricklypear, ragweed, leafy spurge, and invasive blackberry. Fluroxypyr has been shown to have a synergistic effect when mixed with 2,4-D to control certain broadleaf weeds (Smith and Mitra 2006), and to improve control of leafy spurge when mixed with picloram (Peterson 1989). Fluroxypyr mixed with picloram has also been shown to control cholla and pricklypear, which can become dense on desert grassland sites as a result of overgrazing (Cummings and Duncan 2009).

Fluroxypyr has been identified as an option for addressing weeds that are resistant to herbicides with different modes of action. Its uses would likely include oil and gas sites where resistance to currently approved herbicides could be a problem. For instance, kochia that is resistant to ALS-inhibiting herbicides can be treated with fluroxypyr, although kochia can also develop a resistance to fluroxypyr (Montana State University Extension 2011).

Non-Target Plants

Fluroxypyr is a selective herbicide that controls broadleaf species. Therefore it poses a risk to non-target forbs, as well as desirable woody species in treatment areas. Because fluroxypyr is often tank-mixed with other active ingredients, its risk for non-target effects should be considered in conjunction with those of the other active ingredients.

Fluroxypyr would be used at oil and gas sites or other locations where complete removal of vegetation is desired. In these situations, non-target plants would not be present within the treatment area.

The risk assessment for fluroxypyr indicates that this active ingredient poses a high risk to non-target terrestrial plants through direct spray scenarios (Table 4-7). It is assumed that direct spray of some non-target vegetation within the treatment area (if present) would occur, particularly if fluroxypyr is broadcast sprayed over a large area where desirable broadleaf species are present and are susceptible at the time of treatment.

In the case of aquatic habitats, direct spray into a pond or a stream would not pose a risk to non-target aquatic plant species. Therefore, standard buffers between treatment areas and aquatic habitats would be sufficient to prevent harm to aquatic plants. However, an accidental spill of a large quantity of fluroxypyr (i.e., an entire load of herbicide mixed for an application) into a pond would pose a risk to non-target aquatic plants. These risks would be minimized by SOPs, which include conducting mixing and loading operations in areas where an accidental spill would not contaminate aquatic habitats.

Risks to terrestrial plants from off-site drift are generally low, and would be greatest for aerial applications of fluroxypyr. Suitable buffer distances to protect non-target terrestrial plants range from 100 feet for ground applications with a low boom to 1,500 feet for certain airplane applications (Table 4-8). No risks to terrestrial plants were predicted for surface runoff exposure scenarios.

No risks to non-target aquatic plants were predicted for exposures involving off-site drift, surface runoff, or root-zone groundwater flow under a variety of site conditions.

For wind erosion scenarios, no risks were predicted for non-target terrestrial plants under the majority of the evaluated conditions. Low risk was predicted for the Medford, Oregon modeled watershed, with affected plants at a distance of 1.5 km from the original application site.

Additional effects to certain non-target plant species could occur if populations of pollinators were harmed by herbicide spraying. Based on ERAs, fluroxypyr poses a low risk to pollinators under direct spray scenarios. However, ERAs did not identify risks to pollinators from use of aminopyralid or rimsulfuron.

Impacts of Rimsulfuron

Target Plants

Rimsulfuron is a selective, ALS-inhibiting herbicide that controls target weeds by inhibiting the biosynthesis of certain amino acids. It is applied both pre- and post-emergence, and is active in both the xylem and the phloem of the plant. Invasive plants targeted by this active ingredient include cheatgrass, medusahead rye, and other annual grasses that have invaded public lands in the western U.S. The BLM is proposing to use this active ingredient extensively, based on reports that it is effective at controlling winter annual grasses.

Rimsulfuron is effective against cheatgrass and Japanese brome in the fall pre-emergence, or post emergence in the fall or spring. It provides a longer window of control than imazapic, although it must be used at the highest label rates for effective spring applications. Rimsulfuron can also be used to control larger cheatgrass plants than imazapic (Beck, No date).

The effectiveness of rimsulfuron at controlling cheatgrass and medusahead rye has been documented (Zhang et al. 2010), although there is conflicting evidence about its effectiveness relative to currently approved active ingredients (primarily imazapic). Some studies with rimsulfuron indicate that it is not as effective at controlling cheatgrass as either of the currently approved herbicides imazapic or sulfometuron methyl (Clements and Harmon 2013). However, there is also evidence that rimsulfuron is more effective than imazapic under certain conditions (Hirsch et al. 2012).

Non-Target Plants

Rimsulfuron is a selective herbicide that targets annual grasses and other annual species. Therefore, it has minimal effects on perennial grasses and other desirable perennial species. A study in northeastern California rangelands found that rimsulfuron effectively controlled cheatgrass and medusahead rye without substantially impacting sagebrush and desirable perennial grasses such as squirreltail (Zhang et al. 2010). Additionally, there is some evidence that application of rimsulfuron can result in an increase in perennial grass cover at treatment sites, compared to no discernable effect by imazapic (Hergert et al 2012). Therefore, rimsulfuron may benefit perennial non-target plant species, with less post-treatment restoration needed.

Based on information from the ERA, rimsulfuron poses a high risk to non-target terrestrial plants under direct spray scenarios (Table 4-7). Therefore, it is likely that some native plant species within the treatment area (if present) would be affected by treatments involving rimsulfuron, particularly as a result of broadcast spray applications.

An accidental direct spray of rimsulfuron into an aquatic habitat (stream or pond), or a spill of rimsulfuron into a pond, would pose a high risk for adverse effects to non-target aquatic plants. The risk of spills and accidental direct spray would be minimized through the use of SOPs.

Non-target terrestrial vegetation would be at a low risk for adverse effects from off-site drift of rimsulfuron from treatment sites. Based on ERAs, buffers of 100 to 1,900 feet (depending on the application) would be necessary to protect sensitive vegetation from adverse effects from herbicide treatments with rimsulfuron (Table 4-8).

Table 4-7 indicates that there is no risk to aquatic vegetation from off-site drift, based on information provided in the ERA. While there is some indication that chronic (long-term) exposure to rimsulfuron following off-site drift could adversely affect aquatic plants, the modeled scenarios are overly conservative because a chronic exposure is unlikely, and they do not consider flow, adsorption to particles, or degradation of the herbicide over time. The buffers presented in Table 4-8 represent the distance beyond which there would be no risk to aquatic plants under any of the modeled scenarios.

There are no predicted risks to non-target terrestrial or aquatic plants in streams as a result of surface runoff of rimsulfuron from a nearby treatment site. In the pond setting, however, chronic exposures to surface runoff of this herbicide could potentially affect aquatic plants under certain site conditions. Modeled conditions that were associated with adverse effects via surface runoff included high levels of precipitation (25 inches or more a year for sandy soils, 50 inches or more a year for loam soils, and 100 inches or more a year for clay soils).

For wind erosion scenarios, no risks were predicted for non-target terrestrial plants under the majority of the evaluated conditions. Low risk was predicted for the Medford, Oregon modeled watershed, with affected plants at a distance of 1.5 kilometers from the original application site.

Impacts of Tank Mixes and other Mixtures

Mixtures of more than one herbicide are often used to increase the efficacy of a treatment or to control a wider range of target species without requiring multiple applications. Because pre-mixes and tank mixes often include active ingredients with more than one mode of action, they can provide better control of a target species than a single active ingredient. Use of herbicide mixtures is also one strategy for avoiding and managing herbicide-resistant invasive plants (Montana State University Extension 2011). Some species targeted for control by the BLM (e.g., marestail, pigweed, and kochia) have begun to exhibit resistance to currently approved herbicides.

The ERAs for aminopyralid, fluroxypyr, and rimsulfuron did not analyze the potential effects to non-target plants from mixtures involving these herbicides. Tank mixes were discussed in Chapter 2 of this PEIS, in the section Herbicide Formulations Used by the BLM and Tank Mixes. Aminopyralid and fluroxypyr would likely be mixed with numerous other previously approved herbicides, but rimsulfuron would usually be applied on its own.

Some mixtures involving the three new active ingredients could pose a greater risk to non-target plants than treatments involving any of these herbicides alone. Certain plant species may be particularly sensitive to mixtures. Conversely, use of one of the three new herbicides in a mixture in the place of a more harmful herbicide would likely result in a reduced risk to non-target plants.

There is uncertainty associated with the use of mixtures, as the herbicides in a mixture may not interact in an additive manner; some interactions may be antagonistic and others may by synergistic. In general, buffers for the formulated product will be based on the active ingredient that requires the greatest buffer distance.

Impacts by Ecoregion

Table 4-9 provides a summary of the estimated percent of the total acres treated using herbicides within each ecoregion. The table also indicates how the treatments would be spread out among the various vegetation subclasses and macrogroups within each ecoregion. The information provided in Table 4-9 updates Table 4-16 from the 2007 PEIS to reflect the new vegetation classification system utilized by the BLM. The treatment goals and associated target geographic areas and vegetation are the same as those identified for the Preferred Alternative in the 2007 PEIS. Table 4-9 is applicable to all four of the alternatives being considered in this PEIS.

The majority (71 percent) of herbicide treatment acres would be in the Temperate Desert Ecoregion, in shrubland, grassland, and steppe macrogroups. Many treatments in these areas would have the goal of restoring fire-damaged lands in the Great Basin, improving sagebrush communities, and replacing invasive annual grasses with native bunchgrasses and forbs. Treatments may involve the management of such species as sagebrush, rabbitbrush, and other shrub species, annual grasses, and undesirable perennial forbs. Rimsulfuron would likely receive wide use in this

TABLE 4-9
Projected Herbicide Treatments[1], as a Percent of Total Acres Treated, in Each Ecoregion for Each Vegetation Macrogroup under All Alternatives

Vegetation Subclass(es)[2]	Vegetation Macrogroups[2]	Ecoregion							
		Tundra	Subarctic	Marine	Mediterranean	Subtropical Desert	Subtropical Steppe	Temperate Desert	Temperate Steppe
Temperate Forest	California Forest & Woodland Californian-Vancouverian Foothill & Valley Forest & Woodland Southern Vancouverian Montane & Foothill Forest	0	0	0	82-83	0	0	0	0
	Californian-Vancouverian Foothill & Valley Forest & Woodland Vancouverian Lowland & Montane Rainforest	0	0	79	0	0	0	0	0
	Madrean Warm Montane Forest & Woodland	0	0	0	0	5	0	0	0
	Northern Rocky Mountain Lower Montane & Foothill Forest Southern Rocky Mountain Lower Montane Forest Intermountain Singleleaf Pinyon-Western Juniper Woodland Rocky Mountain Two-Needle Pinyon-Juniper Woodland	0	0	0	0	0	0	3-4	1-2
	Rocky Mountain Two-Needle Pinyon-Juniper Woodland	0	0	0	0	0	8-9	0	0
Mediterranean Scrub & Grassland; Temperate & Boreal Shrubland & Grassland	California Chaparral Cool Interior Chaparral	0	0	0	8	0	0	0	0
	California Annual & Perennial Grassland	0	0	0	<1	0	0	0	0
	California Ruderal Grassland & Meadow	0	0	0	10	0	0	0	0
Temperate Forest; Temperate & Boreal Shrubland & Grassland; Warm Semi-Desert Scrub & Grassland	Northern Rocky Mountain-Vancouverian Montane & Foothill Grassland & Shrubland Southern Rocky Mountain Montane Grassland & Shrubland	0	0	0	0	0	0	20-21	44
	Southern Vancouverian Lowland Grassland & Shrubland	0	0	21	0	0	0	0	0
	Northern Rocky Mountain-Vancouverian Montane & Foothill Grassland & Shrubland Southern Rocky Mountain Montane Grassland & Shrubland Great Plains Mixedgrass Prairie & Shrubland Great Plains Shortgrass Prairie & Shrubland	0	0	0	0	0	0	0	26

TABLE 4-9 (Cont.)
Projected Herbicide Treatments[1], as a Percent of Total Acres Treated, in Each Ecoregion for Each Vegetation Macrogroup under All Alternatives

Vegetation Subclass(es)[1]	Vegetation Macrogroups[2]	Ecoregion							
		Tundra	Subarctic	Marine	Mediterranean	Subtropical Desert	Subtropical Steppe	Temperate Desert	Temperate Steppe
Temperate Forest; Temperate & Boreal Shrubland & Grassland; Warm Semi-Desert Scrub & Grassland (cont.)	Great Plains Shortgrass Prairie & Shrubland Apacherian-Chihuahuan Semi-Desert Grassland & Steppe	0	0	0	0	0	33	0	0
	Warm Interior Chaparral	0	0	0	0	26	43-44	0	0
	Chihuahuan Desert Scrub Southern Plains Scrub Woodland & Shrubland	0	0	0	0	32	4	0	0
Cool Semi-Desert Scrub & Grassland	Great Basin & Intermountain Dry Shrubland & Grassland Great Basin & Intermountain Tall Sagebrush Shrubland & Steppe	0	0	0	0	0	0	58-59	0
Annual graminoid or forb[3]		0	0	0	0	0	8	0	2
Perennial forb[3]		0	0	0	<1	<1	1	0	0
Riparian/wetland[3]		0	0	0	<1	36	4	1	0
More than one subclass		0	0	0	0	0	0	18-19	26
Total for all ecoregions		**0**	**0**	**<1**	**4**	**<1**	**9**	**71**	**16**

[1] Refers to treatments with all available herbicides.
[2] See Table 3-4, the Vegetation section in Chapter 3, and Appendix D for a description of vegetation subclasses and macrogroups.
[3] General vegetation types for which no macrogroups exist in these ecoregions.

ecoregion for managing invasive annual grasses, particularly cheatgrass and medusahead rye, in various plant community types. Aminopyralid and fluroxypyr would typically be used in tank mixes to manage broadleaf rangeland weeds such as yellow starthistle, knapweeds, and annual kochia. Treatments to manage invasive plant species can be successful with the currently approved herbicides, but the availability of the three new herbicides would allow the BLM more flexibility when designing treatments.

An additional 25 percent of herbicide treatment acres would be in the Temperate Steppe and Subtropical Steppe Ecoregions, primarily in grassland, shrubland, steppe, and chaparral macrogroups. In the Temperate Steppe ecoregion, herbicide treatments would focus on management of invasive annual and perennial grasses and forbs, including cheatgrass, leafy spurge, knapweeds, and thistles. All three of the new active ingredients could be utilized for certain identified target species. In the Subtropical Steppe Ecoregion, rimsulfuron would be a new option for managing infestations of invasive annual grasses in sagebrush and pinyon-juniper communities, and would help to reduce wildfire risk in these habitats. Similar to the Temperate Steppe Ecoregion, the three new herbicides would offer the BLM more options for meeting its treatment goals in the Subtropical Steppe Ecoregion.

Impacts by Alternative

The primary goals of herbicide treatments would be to control infestations of invasive plants and help restore natural fire regimes. Other goals might be to improve safety and protect infrastructure (e.g., controlling vegetation along roadsides or at oil and gas sites).

Herbicides would commonly be used on rangelands infested by annual grasses, such as cheatgrass and medusahead rye, followed by revegetation with perennial grasses and forbs, as needed. Herbicides would also be used to suppress or thin shrubs such as sagebrush in favor of herbaceous vegetation. In some areas, herbicide treatments might reduce the vigor or cover of perennial grasses and forbs over the short term, but perennial grass and forb communities should improve over the long term as shrub stands are thinned to allow more light and nutrients to reach the understory and competition with annual grasses and forbs is reduced. In most cases, multiple treatments and restoration would be necessary to recover native plant communities and restore natural fire regimes.

All four of the alternatives analyzed in this PEIS involve the same geographic area as far as herbicide treatments, as well as the same assumed total acreage of herbicide treatments annually (932,000 acres). Under all alternatives, the breakdown in usage by ecoregion (Table 4-9) would also be the same. The primary differences among the alternatives are associated with the herbicides that would be available for use, and the relative proportion of their use (summarized in Table 2-4).

Alternative A – Continue Present Herbicide Use (No Action Alternative)

Under the No Action Alternative, the BLM would continue current vegetation management programs in 17 western states, and would treat an estimated 932,000 acres per year using both ground-based and aerial applications of the 18 previously approved herbicides. The impacts to vegetation under this alternative were included in the discussion for the Preferred alternative of the 2007 PEIS (USDOI BLM 2007a:4-66 to 4-67).

Based on projected herbicide use under this alternative (Table 2-4), imazapic, triclopyr, tebuthiuron, clopyralid, and glyphosate would be used most under this alternative, together accounting for approximately 73 percent of the land area that would be treated. The risks and benefits of using these herbicides are discussed in the 2007 PEIS (USDOI BLM 2007a:4-48 to 4-66). Imazapic is used to manage species such as cheatgrass, hoary cress, and perennial pepperweed, and generally has a low to moderate risk to non-target vegetation. Triclopyr is an herbicide registered for aquatic use that is commonly used on woody riparian species, as well as wetland and aquatic invasives (e.g., Eurasian watermilfoil and purple loosestrife). It has a moderate to high risk to non-target plants. Tebuthiuron is used primarily to manage woody invasive plants in rangelands and ROWs. The BLM uses tebuthiuron to thin sagebrush and create more favorable habitat for sagebrush-dependent species such as sage-grouse. It has a moderate to high risk to non-target plants. Clopyralid is also used to control broadleaved weeds, and is used in forest and rangeland areas for the management of species such as diffuse and spotted knapweed, yellow starthistle, and bull, Canada, Scotch, and musk thistle. It generally has a low to moderate risk to non-target plants. Glyphosate is commonly used in areas where bare ground is desired, and in aquatic and riparian habitats to manage invasive plants such as purple loosestrife, giant reed, and water lilies. It generally has a low to moderate risk to non-target plants.

The goals, effectiveness, and extent of herbicide treatments would be much the same as at present. Herbicide treatments would be used in conjunction with other treatment methods to manage invasive plant species, with varying degrees of effectiveness at establishing and maintaining native and desirable plant communities. Additionally, repeated use of the same herbicides could allow target invasive plants to develop herbicide resistance over time. With multiple treatments over the long term, successful control of fire-adapted invasive species such as cheatgrass would help reduce fire risk, and maintenance and restoration of native plant communities would help maintain and restore historic fire regimes.

Monitoring of treatment sites would continue to be conducted to determine the effectiveness of treatments and the need for retreatment. Site revisits would be made to compare the targeted population size against pre-treatment data, to compare pre-treatment and post-treatment data, and to assess the establishment and recovery of desirable vegetation.

Alternative B – Allow for Use of Three New Herbicides in 17 Western States (Preferred Alternative)

Under this alternative, herbicide treatment projects would be much the same as those under the No Action Alternative, except that aminopyralid, fluroxypyr, and rimsulfuron would be available for use in addition to all of the currently approved herbicides.

Based on projected herbicide use under this alternative (Table 2-4), rimsulfuron, triclopyr, tebuthiuron, clopyralid, aminopyralid, and imazapic would be used the most, together accounting for approximately 81 percent of the land area that would be treated. The new active ingredients would account for 27 percent of all acres treated, with rimsulfuron and aminopyralid accounting for 26 percent of all acres treated. Compared to the No Action Alternative, use of imazapic, glyphosate, and picloram would decrease substantially with the introduction of these chemicals. Use of fluroxypyr would be minimal under this and the other action alternatives.

While the three new herbicides are generally low risk, they would still impact non-target plants under direct spray and spill scenarios, much like the herbicides that would be used most extensively under the No Action Alternative. Therefore, there would not be a substantial difference between the No Action Alternative and the Preferred Alternative in terms of risk to non-target plants.

The introduction of the new active ingredients could increase the effectiveness of certain components of vegetation management by providing additional options for targeting invasive plants. Aminopyralid could be used to control of many of the species currently targeted by picloram (e.g., knapweeds, thistles, and yellow starthistle). This active ingredient is likely to receive an aquatic registration in the near future that would allow for incidental overspray of aquatic habitats during treatment of wetland and riparian vegetation. With such a registration, aminopyralid could be used in place of glyphosate for management of certain invasive plants in riparian areas. Because aminopyralid is more selective than glyphosate, it may be less likely to result in removal of non-target riparian vegetation.

Rimsulfuron would typically be used to manage cheatgrass and other annual grasses, and as such could be used instead of imazapic in some instances. Rimsulfuron has been observed to be more effective than imazapic in certain areas.

Fluroxypyr would be used minimally, but may increase the effectiveness of certain herbicide treatments relative to the No Action Alternative by controlling target species that are resistant to other herbicides, improving control of target species when mixed with other active ingredients, and reducing the amount of other herbicides products used in treatments.

Overall, there would be no change to the goals or extent of herbicide treatment programs, relative to the No Action Alternative, although it is possible that there could be an improvement in the effectiveness of certain treatments with the availability of the new herbicides. Improved effectiveness of treatments could allow the BLM to better meet its goals of managing undesirable vegetation, reducing fire risk, and restoring natural fire regimes.

Alternative C – No Aerial Application of New Herbicides

Under Alternative C, herbicide treatment projects would be much the same as those under the No Action and Preferred Alternatives, except that in addition to all the other currently approved herbicides, aminopyralid, fluroxypyr, and rimsulfuron would be available for use for ground treatments only.

Based on projected herbicide use under this alternative (Table 2-4), triclopyr, tebuthiuron, imazapic, clopyralid, and glyphosate would be used the most, together accounting for approximately 69 percent of the land area that would be treated, which is similar to the No Action Alternative. The new herbicides would account for approximately 10 percent of all acres treated, with rimsulfuron and aminopyralid accounting for 9 percent of all acres treated, or about one third of the amount under the Preferred Alternative.

Overall risks to non-target plants under this alternative would not be substantially different than under the other alternatives. The most commonly used herbicides would continue to pose a risk to non-target plants as a result of herbicide treatments, particularly under direct spray and spill scenarios.

Prohibiting aerial spraying of the three new herbicides would limit their usefulness. For example, given the abundance of cheatgrass and other invasive annual grasses and the extensiveness of planned treatments for these species, aerial spraying is one of the most cost-effective treatment methods. The BLM would not have the option to aerial spray rimsulfuron, and would instead continue to utilize imazapic for these applications. While the BLM would still have some options to utilize the three new active ingredients to increase the effectiveness of treatments, these options would be limited relative to the Preferred Alternative.

Alternative D – No Use of New Acetolactate Synthase-inhibiting Active Ingredients (No Rimsulfuron)

Under this alternative, herbicide treatment projects would be much the same as under the other alternatives. Similar to the other action alternatives, new active ingredients would be available for use, but they would only include aminopyralid and fluroxypyr. Based on projected herbicide use under this alternative (Table 2-4), triclopyr, tebuthiuron, clopyralid, glyphosate, and aminopyralid would be used the most, together accounting for approximately 70 percent of the land area that would be treated. New herbicides would account for approximately 11 percent of all acres treated, with aminopyralid accounting for 10 percent.

In general, risks to non-target plants would be similar to those under the other alternatives. Herbicides would continue to pose a risk to non-target plants, particularly under direct spray and spill scenarios.

Prohibiting the use of rimsulfuron would give the BLM one fewer herbicide option for its herbicide treatments, relative to the Preferred Alternative and Alternative C. The BLM would continue to utilize imazapic for management of cheatgrass and other annual grasses. However, aminopyralid would be available as an option for management of undesirable broadleaved plants in upland and riparian habitats, and use of picloram would decrease by approximately the same amount as under the Preferred Alternative. The availability of aminopyralid and fluroxypyr could increase the effectiveness of certain treatments relative to the No Action Alternative, but this increase would be less than under the Preferred Alternative.

Mitigation for Herbicide Treatment Impacts

In addition to the SOPs identified earlier in this section and in the 2007 PEIS (USDOI BLM 2007a:Table 2-8), the following measures are recommended to reduce impacts to non-target vegetation from the use of herbicides:

- Use Table 4-8 to establish herbicide-specific buffer zones around downstream water bodies, and associated habitats and non-target plant species/populations of interest for aminopyralid, fluroxypyr, and rimsulfuron. Consult the ERAs for more specific information on appropriate buffer distances under different soil, moisture, vegetation, and application scenarios.

Special Status Plant Species

Introduction

As discussed in Chapter 3, public lands in the western U.S. support numerous plant species that have been given a special status based on their rarity or sensitivity. Special status plants include approximately 165 species that are federally listed as threatened or endangered, or are proposed for federal listing. The remaining special status species include candidates for federal listing, and other species that warrant special attention and could potentially require federal listing in the future. Many of these species are threatened by competition with non-native plants and other invasive species. The *Vegetation Treatments Using Aminopyralid, Fluroxypyr, and Rimsulfuron on Bureau of Land Management Lands in 17 Western States Biological Assessment* (USDOI BLM

2015) provides a description of the distribution, life history, and current threats of each federally-listed plant species, as well as species proposed for listing. The BA also discusses the risks to threatened and endangered species, and species proposed for listing, associated with the use of aminopyralid, fluroxypyr, and rimsulfuron by the BLM.

Impacts Assessment Methodology

The BLM reviewed the literature and findings from ERAs conducted by the BLM to assess the impacts to sensitive plant species from the use of herbicides (AECOM 2014a-c). The ERA methods are summarized in the Vegetation section of this chapter, and are presented in more detail in the *Vegetation Treatments Programmatic EIS Ecological Risk Assessment Protocol* (ENSR 2004) and in Appendix C of the 2007 PEIS.

The acute endangered species LOC for plants is 1, which is the same as that for typical plant species. However, separate plant toxicity endpoints were selected to provide extra protection to special status plant species. Thus, ERAs for some herbicides predicted higher risks for special status plant species than for "typical" plant species under certain exposure scenarios.

The potential risks to sensitive plant species from use of herbicides can be minimized by following certain SOPs. These SOPs were identified in the 2007 PEIS (USDOI BLM 2007a:Table 2-8, 4-71), and would continue to be implemented at the local level based on site conditions. These SOPs include:

- Survey for special status plant species, at a time they can be found and identified, before treating an area. Consider effects to special status species when designing herbicide treatment programs.
- Use drift reduction agents to reduce the risk of drift hazard.
- Use a selective herbicide and a wick or backpack sprayer to minimize risks to special plants.

Summary of Herbicide Impacts

The 2007 PEIS provides a general discussion of potential impacts (adverse and beneficial) to special status plant species from herbicide treatments (USDOI 2007a:4-71 to 4-73). This discussion considers the BLM's vegetation treatment program as a whole, and therefore would also be applicable to herbicide treatments that utilize the three new chemicals.

As many special status plant species are threatened by the spread of non-native plants, fuels reduction and control of competing vegetation are important components of management programs for special status plant species. Therefore, herbicide treatments conducted as part of these programs would be expected to benefit populations of special status plant species. Additionally, general program goals of restoring native communities and minimizing fire risk would also benefit these species by improving habitat conditions and in some cases reducing the risk of extirpation as a result of fire. The BA provides additional information on which listed and proposed plant species are most at risk from competition with non-native plants and for extirpation of populations from fire.

All herbicides would have the potential to harm populations and individuals of special status plant species. At the local level, locations and risks to sensitive plant populations would be considered when designing treatment projects, and the appropriate precautions would be taken to avoid impacts to these species. In some cases, manual spot treatments of herbicides would be the only feasible option for avoiding impacts to listed species. In other cases, some level of short-term mortality may be acceptable for long-term habitat improvement and increase in population size.

Impacts from Use of the Three New Herbicides

Based on information in the ERAs, all three herbicides would pose risks to terrestrial special status plant species under direct spray and off-site drift scenarios. The greatest risks to terrestrial special status plants from off-site drift would be associated with aerial applications, where buffer distances of 900 to 2,000 feet (depending on application rate and site conditions) would likely be required to protect populations of special status plant species (Table 4-8). For ground applications, smaller buffers of 25 to 700 feet would be required.

The vast majority of the BLM's special status plant species are terrestrial. However, there are also aquatic plant species (including species in wetland habitats) for which separate risk analyses were completed.

Accidental direct spray or spill of fluroxypyr or rimsulfuron could result in harm to aquatic special status plant species. In the case of aminopyralid, however, ERAs did not predict risks to sensitive non-target aquatic plants under these exposure scenarios. Should aminopyralid receive an aquatic registration in the future that allows for incidental overspray into aquatic habitats, sensitive aquatic plants would not be harmed by applications in adjacent upland or wetland areas. Off-site drift of fluroxypyr would not be expected to harm sensitive aquatic plants, assuming standard BLM buffers around aquatic habitats. However, special status aquatic plants would be at risk for harm from spray drift of rimsulfuron. Buffers of 100 to 300 feet would likely be required for ground applications, and buffers of 1,000 to 1,400 feet would likely be required for aerial applications of rimsulfuron.

Based on the predictions in the ERA, adverse effects to terrestrial special status plant species should not occur as a result of surface runoff of any of the three herbicides. Additionally, surface runoff of aminopyralid or fluroxypyr would not harm sensitive aquatic plants in downslope habitats. However, surface runoff of rimsulfuron would have the potential to adversely affect special status aquatic plants, particularly in sandy soils and in areas with greater than 50 inches of rainfall per year.

Additional indirect effects to certain special status plant species could occur if populations of pollinators were harmed by herbicide spraying. However, according to risk assessments, risks to pollinators would be less than those associated with direct spray of the rare plants themselves. No adverse effects to pollinators were predicted for direct spray or dermal contact with vegetation sprayed by aminopyralid or rimsulfuron. Low risks to pollinators were predicted under scenarios involving direct spray by fluroxypyr. Management efforts to protect rare plants would also help prevent harm to insects in the vicinity. These management efforts include:

- Designating buffer zones around rare plants.
- Managing herbicide drift especially to nearby blooming plants.
- Using typical rather than maximum rates of herbicides in areas with rare plants.
- Choosing herbicide formulations that are not easily carried by social insects to hives, hills, nests, and other ”homes” in areas with rare plants.
- Choosing herbicides that degrade quickly in the environment when herbicides must be used in rare plant habitat.
- Timing the herbicide applications when pollinators are least active, such as in the evenings or after blooming has occurred in rare plant habitat, and if necessary dividing the rare plant habitat into several treatments rather than one large treatment to keep from treating all blooming species at one time.

Effects to pollinators would be short-term, and population-level effects are not anticipated when these types of management practices are incorporated into project design when rare plants are present.

Alternative A – Continue Present Herbicide Use (No Action Alternative)

Impacts to special status plant species under this alternative were summarized in the 2007 PEIS under the discussion for the Preferred Alternative (USDOI BLM 2007a:4-74). Up to 932,000 acres of public lands would be treated with herbicides annually. Herbicide use would be associated with risks to special status plant species, although treatments would be designed at the local level to avoid or minimize risks to these species. Regardless of measures to avoid sensitive plant populations, there would be some risk of accidental exposure to herbicides. As identified in the 2007 PEIS, active ingredients with the greatest risks for adverse effects to special status plants would be 2,4-D, bromacil, diquat, diuron, hexazinone, and sulfometuron methyl.

Under this alternative, populations of special status plant species would benefit from herbicide treatments that reduce fuels (such as cheatgrass) and control non-native, invasive species that compete with native plants. Aminopyralid, fluroxypyr, and rimsulfuron would not be approved for use under this alternative, but the species that they target would continue to be managed using currently approved herbicides.

Alternative B – Allow for Use of Three New Herbicides in 17 Western States (Preferred Alternative)

Under this alternative, the total acreage of public lands treated with herbicides annually would be the same as

under the No Action Alternative and the other action alternatives. However, aminopyralid, fluroxypyr, and rimsulfuron could be used as part of vegetation management programs throughout the 17 western states. Special status plant species would continue to be at risk for harm from contact with herbicides, although treatments would continue to be designed to avoid or minimize impacts to special status plant species.

In considering the active ingredients with the greatest risk to non-target plants, discussed under Alternative A, there would be little change in the amount of these ingredients used under the Preferred Alternative, and all except 2,4-D would continue to make up a very small component of the total amount of herbicide used annually. Under the Preferred Alternative, 2,4-D use is estimated at 5 percent, versus 6 percent under the No Action Alternative.

While the three new active ingredients would not offer substantially different types of target species control, they may be able to increase the efficacy of individual treatments by addressing herbicide resistance issues, adding to the strength of other herbicides in tank mixes, and performing better than currently approved herbicides under certain site conditions.

Alternative C – No Aerial Application of New Herbicides

This alternative would be similar to the other alternatives as far as risks and benefits to special status plant species. Treatment acres would be the same as those under the other alternatives, and the suite of chemicals available would be the same as under the Preferred Alternative, except that aminopyralid, fluroxypyr, and rimsulfuron would only be available for application using ground methods; aerial spraying of these chemicals would not occur.

Since aerial spraying of herbicides would not occur in habitats that support listed species, and is unlikely to occur in many habitats that support populations of special status plant species, this alternative would not be substantially different than the Preferred Alternative as far as risks to sensitive plant species.

Herbicides with the greatest risk to non-target plants would continue to be used in small amounts, and at levels similar to those under the No Action Alternative.

Alternative D – No Use of New Acetolactate Synthase-inhibiting Active Ingredients (No Rimsulfuron)

This alternative would be similar to the other alternatives as far as total acres treated and herbicides available for use, except that rimsulfuron would not be added to the list of approved active ingredients. Aminopyralid and fluroxypyr would be integrated into herbicide treatment programs, including those designed to improve habitats occupied by, or that could be occupied by, special status plant species.

Because rimsulfuron would not be available for use, the relative amount of each herbicide used under this alternative would be very similar to the breakdown under the No Action Alternative. Most importantly, the relative use of herbicides with the greatest risks to non-target plants also would be very similar to the use of these chemicals under the No Action Alternative. These chemicals would continue to be used in small quantities, and risks to non-target sensitive plant species would be similar to those under the other alternatives.

Mitigation for Herbicide Treatment Impacts

When using the previously approved herbicides, the BLM would continue to follow mitigation for vegetation and special status plants identified in the 2007 PEIS. The following mitigation is recommended to reduce the likelihood of impacts to special status plant species from applications of aminopyralid, fluroxypyr, and rimsulfuron. This mitigation should be implemented in addition to the SOPs designed to protect plants presented in Chapter 2 and the general mitigation recommended in the Vegetation section.

- To protect special status plant species, implement all conservation measures for plants presented in the *Vegetation Treatments Using Aminopyralid, Fluroxypyr, and Rimsulfuron on Bureau of Land Management Lands in 17 Western States Biological Assessment* (USDOI BLM 2015). Apply these measures to sensitive plant species, as well as listed species.

Fish and Other Aquatic Organisms

Introduction

The proposed herbicide treatments have the potential to affect fish and other aquatic organisms, predominantly through indirect effects to aquatic habitats and adjacent riparian and upland habitats. Noxious weeds and other non-native invasive species can be detrimental to aquatic habitats. Infestations of riparian systems and other habitats by non-native plants can reduce the ability of these systems to support fish and other aquatic organisms. Non-native plants can affect stream morphology and habitat characteristics, bank erosion, flow levels, and populations of native insects that provide a food source for fish. Removal of invasive species can help to restore a more complex vegetative and physical structure and natural levels of processes such as sedimentation and erosion.

Scoping Comments and Other Issues Evaluated in the Assessment

None of the scoping comments received were specific to fish and other aquatic organisms. However, comments concerned with the potential for the new herbicides to impact water resources would also apply to aquatic organisms and their habitats. Additionally, comments that support the new herbicides for their limited environmental risk are applicable.

Standard Operating Procedures

The SOPs listed in the 2007 PEIS would be followed for treatments with aminopyralid, fluroxypyr, and rimsulfuron, as applicable:

- Develop and update an operational plan for each herbicide project that includes information on project specifications; key personnel responsibilities; communication procedures; safety, spill response, and emergency procedures; and minimum buffer widths for herbicides not approved for aquatic use.
- Use appropriate buffer zones based on label and risk assessment guidance.
- Minimize treatments near fish-bearing water bodies during periods when fish are in life stages most sensitive to the herbicide(s) used, and use spot rather than aerial treatments.
- Use appropriate application equipment and methods near water bodies if the potential for off-site drift exists.
- Where feasible, use spot hand applications within 20 feet of perennial streams and non-perennial streams with flowing water at the time of application.
- Use herbicides that are least toxic to fish, yet still effective.
- For treatment of aquatic vegetation, 1) treat only that portion of the aquatic system necessary to achieve acceptable vegetation management, 2) use the appropriate application method to minimize the potential for injury to desirable vegetation and aquatic organisms, and 3) follow use restrictions on the herbicide label.

Additional mitigation for fish and aquatic organisms is presented in the ROD for the 2007 PEIS (USDOI BLM 2007b:Table 2). Many of these mitigation measures would apply to treatments involving the three new herbicides, or tank mixes with these active ingredients.

- Limit the use of terrestrial herbicides (especially diuron) in watersheds with characteristics suitable for potential surface runoff that have fish-bearing streams during periods when fish are in life stages most sensitive to the herbicide(s) used.
- To protect special status fish and other aquatic organisms, implement all conservation measures for aquatic animals presented in the *Biological Assessment for Vegetation Treatments on Bureau of Land Management Lands in 17 Western States* (USDOI BLM 2007f).
- Establish appropriate herbicide-specific buffer zones for water bodies, habitats, or fish or other aquatic species of interest (see the 2007 PEIS [USDOI BLM 2007a:Appendix C, Table C-16], as well as recommendations in individual ERAs [AECOM 2014a-c]).
- Consider the proximity of application areas to salmonid habitat and the possible effects of

herbicides on riparian and aquatic vegetation. Maintain appropriate buffer zones around salmonid-bearing streams (see the 2007 PEIS [USDOI BLM 2007a:Appendix C, Table C-16], as well as recommendations in individual ERAs [AECOM 2014a-c]).

- At the local level, consider effects to special status fish and other aquatic organisms when designing treatment programs.

Impacts Assessment Methodology

The methods used to assess impacts to fish and aquatic organisms from the three new herbicides were the same as the methods described in the 2007 PEIS (USDOI BLM 2007a:4-77 to 4-79). A brief overview of the risk assessment process is provided here.

Risk Assessment Methodology

Aquatic receptors (fish and aquatic invertebrates) were evaluated to determine the effects of herbicide exposure in terms of certain assessment endpoints and associated measures of effect. The assessment endpoint is an expression of the value that is to be protected. In the case of aquatic organisms, assessment endpoints include survival, growth, and reproduction. These assessment endpoints generally reflect direct effects on organisms, but indirect effects were also considered.

Measures of effect are measurable changes in an attribute of an assessment endpoint (or its surrogate, as discussed below) in response to a stressor to which it is exposed (USEPA 1998b). For ERAs, they generally consisted of acute and chronic toxicity data (from pesticide registration documents and from the available scientific literature) for the most appropriate surrogate species.

Because the BLM uses herbicides in a variety of programs with several different application methods, the following exposure scenarios were considered to assess the potential ecological impacts of herbicides to fish and other aquatic organisms under a variety of uses and conditions:

- Direct spray of the receptor or water body.
- Off-site drift of spray to terrestrial areas and water bodies.
- Surface runoff from the application area to off-site soils or water bodies.
- Wind erosion resulting in deposition of contaminated dust into water bodies.
- Accidental spills to water bodies.

Direct spray scenarios considered both a pond (1/4 acre, 1 meter deep) and a stream (representative of Pacific Northwest low-order streams that provide habitat for critical life stages of anadromous salmonids). Accidental spill scenarios were limited to a pond, which represents a worst-case scenario for a spill into an aquatic habitat.

The AgDRIFT computer model was used to estimate off-site herbicide transport due to spray drift. The GLEAMS computer model was used to estimate off-site transport of herbicides in surface runoff and root zone groundwater transport. The CALPUFF computer model was used to predict the transport and deposition of herbicides sorbed (i.e., reversibly or temporarily attached) to wind-blown dust. Each model simulation was approached with the intent of predicting the maximum potential herbicide concentration that could result from the given exposure scenario.

Toxicological data for aquatic organisms were extrapolated from data for representative or surrogate species. Data describing both acute and chronic effects were used to generate RQs for addressing potential risks to aquatic receptors (see the ERAs [AECOM 2014a-c] or the 2007 PEIS [USDOI BLM 2007a:4-100] for additional discussion of these calculations). In order to address potential risks to these receptors from exposure to the herbicides, RQs were compared to LOCs defined by the USEPA for screening the potential risk of pesticides. Distinct USEPA LOCs were used for acute and chronic risks, and for potential increased risks to special status species. For non special status fish and aquatic invertebrates, LOCs were 0.5 for acute high risk, and 1 for chronic risk. Wherever the RQ exceeded the applicable LOCs, it was assumed that adverse toxicological effects to the group in question (fish or invertebrates) could occur. Corresponding levels of risk (none, low, medium, or high) were obtained by determining the factor by which the RQ exceeded the LOC, and the number of modeled scenarios in which an exceedance occurred.

Adjuvants, Degradates, Inert Ingredients, and Tank Mixes

Adjuvants

The potential risks to aquatic organisms from adjuvants were raised as a concern during the 2007 PEIS process. Adjuvants generally function to enhance or prolong the activity of an active ingredient, and are not under the same registration guidelines as pesticides. In general, adjuvants comprise a relatively small portion of the volume of herbicide applied. Adjuvants listed for use with the three new herbicides include the following:

- Aminopyralid – a nonionic surfactant.
- Fluroxypyr – a methylated seed oil surfactant.
- Rimsulfuron – several types of spray adjuvants (e.g., nonionic surfactant, petroleum crop oil concentrate, modified seed oil, ammonium nitrogen fertilizer, and combination adjuvant products).

The BLM reviewed toxicity data for these adjuvants to assess risks to aquatic life. In addition, the GLEAMS model was used in the ERAs to estimate the potential portion of an adjuvant that might reach an adjacent water body via surface runoff.

Degradates

It was beyond the scope of the ERAs to evaluate all of the possible degradates of the herbicide formulations being considered in this PEIS. Degradates may be more or less mobile and more or less toxic in the environment than their source herbicides (Battaglin et al. 2003). Differences in environmental behavior (e.g., mobility) and toxicity between parent herbicides and degradates makes prediction of potential impacts challenging. For example, a less toxic, but more mobile bioaccumulative, or persistent degradate may have a greater adverse impact due to residual concentrations in the environment. The lack of data on the toxicity of degradates of the specific herbicides represents a source of uncertainty in the risk assessment.

This PEIS relies on information obtained during preparation of the 2007 PEIS to determine the likely effects of degradates on aquatic organisms. The BLM conducted studies to evaluate information on degradates and try to determine if it is likely for degradates to be more toxic than the parent compounds (active ingredients; see Appendix D of the 2007 PEIS).

Inert Ingredients

The BLM reviewed confidential information on inert compounds used in herbicide formulations with aminopyralid, fluroxypyr, and rimsulfuron. Additionally, the ERAs used the GLEAMS model to simulate the effects of a generalized inert compound in a base-case watershed (annual precipitation rate of 50 inches per year, application area of 10 acres, slope of 0.05, surface roughness of 0.015, erodibility of 0.401 tons per acre, vegetation type of “weeds”) with a sand soil type (see Appendix D of the ERAs; AECOM 2014a-c).

Tank Mixes

The ERAs for aminopyralid, fluroxypyr, and rimsulfuron did not include a quantitative evaluation of potential tank mixes for these active ingredients. Therefore, information on simulations of tank mixes in risk assessments completed for the 2007 PEIS were used as guidance for determining how risks to aquatic organisms may change when a tank mix is used, as compared to the active ingredient alone. Aquatic organisms may be at greater risk from the mixed application than from the active ingredient alone. Typical tank mixes of the three herbicides are discussed in Chapter 2 of this PEIS.

Summary of Herbicide Impacts

The general impacts to fish and other aquatic organisms as a result of herbicide treatments are discussed in the 2007 PEIS (USDOI BLM 2007a:4-80). Herbicides may come into contact with fish and aquatic invertebrates by entering a water body, with potential impacts that include mortality, reduced productivity, abnormal growth, and alteration of critical habitat. Factors that influence an herbicide’s risk to aquatic organisms include size of aquatic buffers, application rate, application method, precipitation rate, soil type, application rate, and herbicide mobility and persistence.

All herbicides pose some risk to non-target terrestrial and aquatic plants. These risks should be considered, as damage to riparian and aquatic plants may affect fish and aquatic invertebrates. Potential effects from vegetation removal in riparian areas include loss of necessary habitat components (i.e., cover and food), increased sedimentation into aquatic habitats, altered nutrient dynamics, and increased water temperature due to a reduction in shade. The sections on Vegetation and Wetlands and Riparian Areas in this chapter discuss

these risks, as well as herbicide application practices that can be used to reduce risk.

Based on the likely use of the three new active ingredients, wide-scale removal of riparian vegetation is unlikely to occur. Out of the three, fluroxypyr and rimsulfuron would typically not be used near water, except possibly for spot treatments of certain target species. Aminopyralid would be used in riparian treatments for selective removal of certain species (e.g., knapweeds), but extensive removal of riparian vegetation would be unlikely. Additionally, aminopyralid would provide an alternative to glyphosate, which is less selective and more likely to result in removal of non-target vegetation.

The BLM's land management goals include restoring and enhancing fish habitat, and restoring and maintaining proper functioning condition of riparian and wetland areas. Vegetation treatment programs in these areas include herbicide treatments to remove noxious weeds and other invasive species from these areas. Such treatments, as part of an overall habitat improvement program, would be expected to have a beneficial effect on fish and other aquatic organisms by improving stream/aquatic habitat conditions and restoring important riparian habitat components for juvenile fish growth, development, and survival, such as streambank structure and complexity, habitat complexity, and water quality (Groot and Margolis 1991).

Impacts of Aminopyralid

Aminopyralid is not currently registered for aquatic uses, although it may receive an aquatic registration in the near future that would address incidental overspray of aquatic areas during treatment of adjacent habitats. Even with this registration, aminopyralid would not be used to manage aquatic vegetation, and would not be applied directly to the water column like other aquatic herbicides.

The ERA for aminopyralid indicates that this herbicide would not pose a risk to fish or aquatic invertebrates in ponds or streams as a result of any of the modeled exposure scenarios (Table 4-10). The ERA included a direct spray scenario and a worst-case scenario involving a spill of the active ingredient into the aquatic habitat, as well as off-site drift and surface runoff scenarios.

Based on toxicity data reviewed for the ERA, aminopyralid exposures to fish of as high as 100 ppm did not result in any observable mortality or sub-lethal effects. Additionally, the ERA indicates that aminopyralid is not likely to accumulate in fish tissue. Toxicity data for aquatic invertebrates was similar, with no adverse effects observed at concentrations of nearly 100 ppm.

Impacts of Fluroxypyr

Fluroxypyr is not registered for use in aquatic systems. Therefore, routes for exposure to aquatic organisms would be limited to accidental direct spray through a misapplication or an accidental spill, or through off-site drift or surface runoff. The SOPs and guidelines listed in the 2007 PEIS and discussed in Chapter 2 of this document would minimize the risks for misapplications or accidental spills into aquatic habitats. Relevant SOPs include preparing a spill contingency plan in advance of treatments, mixing and loading herbicide products in an area where an accidental spill would not reach a water body, not rinsing spray tanks in or near water bodies, following product labels for use and storage, and having licensed applicators apply the herbicides.

The ERA for fluroxypyr indicates that this herbicide would not pose a risk to non special status fish or aquatic invertebrates in ponds or streams under any of the modeled exposure scenarios (Table 4-10). The ERA included a direct spray scenario and a worst-case scenario involving a spill of the active ingredient into the aquatic habitat, as well as off-site drift and surface runoff scenarios.

Based on toxicity data review presented in the ERA, no effects to fish were observed after exposure to fluroxypyr at concentrations of approximately 7 mg/L. The ERA also indicated that based on the literature, fluroxypyr may accumulate in fish tissue. Toxicity data for aquatic invertebrates indicated that no adverse effects were observed at concentrations of 56 mg/L. While the ERA considered freshwater species as surrogates, information from the USEPA (1998a) indicates that the acid form of fluroxypyr is highly toxic to certain marine invertebrates.

Impacts of Rimsulfuron

Rimsulfuron is not registered for use in aquatic systems. Therefore, possible routes for exposure to aquatic organisms would be the same as those for fluroxypyr: accidental direct spray or spill, off-site drift, or surface runoff. The SOPs and guidelines discussed in the previous section for fluroxypyr would help prevent and control spills and other releases into aquatic habitats.

Based on the results of the ERA, none of the modeled exposure scenarios were associated with risks to fish or aquatic invertebrates in streams or ponds, even under the worst case accidental spill scenarios (Table 4-10). Based on toxicity data reviewed for the ERA, exposures to concentrations of rimsulfuron as high as 390 mg/L does not result in adverse effects to fish, although the potential for chronic effects is not known. Additionally, the ERA indicates that rimsulfuron is not likely to accumulate in fish tissue. Lower concentrations of the herbicide were noted to cause adverse effects to aquatic invertebrates, with test organisms affected at 50 mg/L of rimsulfuron.

Impacts of Adjuvants, Degradates, Inert Ingredients, and Tank Mixes

Adjuvants

The findings of analysis of adjuvants in the ERA indicate that there is no risk to aquatic organisms associated with the adjuvant identified for aminopyralid, and very low risks associated with adjuvants identified for fluroxypyr and rimsulfuron. The methylated seed oil identified for fluroxypyr may be a concern under spill and long-term exposure scenarios, neither of which are likely under the proposed treatment programs. An

TABLE 4-10
Risk Categories Used to Describe Herbicide Effects on Non Special Status Fish and Aquatic Invertebrates According to Exposure Scenario

Application Scenario	Aminopyralid		Fluroxypyr		Rimsulfuron	
	Typ[1]	Max[1]	Typ	Max	Typ	Max
Direct Spray/Spill						
Fish pond	0[2] [2:2]	0 [4:4]	0 [2:2]	0 [4:4]	0 [2:2]	0 [4:4]
Fish stream	0 [2:2]	0 [2:2]	0 [2:2]	0 [2:2]	0 [2:2]	0 [2:2]
Aquatic invertebrates pond	0 [2:2]	0 [4:4]	0 [2:2]	0 [4:4]	0 [2:2]	0 [4:4]
Aquatic invertebrates stream	0 [2:2]	0 [2:2]	0 [2:2]	0 [2:2]	0 [2:2]	0 [2:2]
Off-Site Drift						
Fish pond	0 [36:36]	0 [36:36]	0 [36:36]	0 [36:36]	0 [36:36]	0 [36:36]
Fish stream	0 [36:36]	0 [36:36]	0 [36:36]	0 [36:36]	0 [36:36]	0 [36:36]
Aquatic invertebrates pond	0 [36:36]	0 [36:36]	0 [36:36]	0 [36:36]	0 [36:36]	0 [36:36]
Aquatic invertebrates stream	0 [36:36]	0 [36:36]	0 [36:36]	0 [36:36]	0 [36:36]	0 [36:36]
Surface Runoff						
Fish pond	0 [84:84]	0 [84:84]	0 [84:84]	0 [84:84]	0 [84:84]	0 [84:84]
Fish stream	0 [84:84]	0 [84:84]	0 [84:84]	0 [84:84]	0 [84:84]	0 [84:84]
Aquatic invertebrates pond	0 [84:84]	0 [84:84]	0 [84:84]	0 [84:84]	0 [84:84]	0 [84:84]
Aquatic invertebrates stream	0 [84:84]	0 [84:84]	0 [84:84]	0 [84:84]	0 [84:84]	0 [84:84]

[1] Typ = Typical application rate; and Max = Maximum application rate.
[2] Risk categories: 0 = No risk (majority of RQs < applicable LOC for non special status species). The Risk Category is based on the risk level of the majority of risk quotients observed in any of the scenarios for a given exposure group and receptor type. The reader should consult the risk tables in Chapter 4 of the ERAs (AECOM 2014a-c) to determine the specific scenarios that result in the displayed level of risk for a given receptor group.

inert/adjuvant compound identified for rimsulfuron could potentially cause behavioral and physiological effects at very high exposure scenarios, which are also unlikely.

When selecting adjuvants, BLM land managers must follow all label instructions and abide by any warnings. In general, adjuvants compose a relatively small portion of the volume of herbicide applied. Nonetheless, selection of adjuvants with limited toxicity and low volumes is recommended for applications near aquatic habitats to reduce the potential for the adjuvant to influence the toxicity of the herbicide.

Degradates

Based on the analysis of degradates in the 2007 PEIS, previous studies have determined that degradates are often not identified or named in registration documents and their physical and chemical attributes are often poorly understood. The ERAs completed for aminopyralid, fluroxypyr, and rimsulfuron factored in the lack of data on the toxicity of degradates as a source of uncertainty in the risk assessment process. Numerous degradates of other herbicides have a similar or reduced toxicity to the parent herbicide, but some may be more toxic than the parent herbicide (Sinclair and Boxall 2003).

Inert Ingredients

As a result of the BLM's review of confidential information on inert compounds, it was found that all of the inert ingredients identified in the formulations were classified as approved for "food and nonfood use," which means that they are approved for use in pesticide products applied to food.

The ERAs determined that inert ingredients associated with aminopyralid, fluroxypyr, and rimsulfuron are not predicted to occur at levels that would cause acute toxicity to aquatic life. It is assumed that toxic inert ingredients would not represent a substantial percentage of the herbicide, and that minimal impacts to aquatic habitats would result from these ingredients.

Tank Mixes

Use of tank mixes can result in changes to the toxic effects of herbicides in the mixture. Herbicide interactions can be additive, synergistic, or antagonistic, and the mixture may have more or less toxicity than any of the individual products. Based on simulations of tank mixes in risk assessments completed for the 2007 PEIS, aquatic organisms may be at greater risk from applications of a mix of active ingredients than from use of a single active ingredient alone. There is some uncertainty in this evaluation because herbicides in tank mixes may not interact in an additive manner. Thus, the evaluation may overestimate risk if the interaction is antagonistic, or it may underestimate risk if the interaction is synergistic. In addition, other products may also be included in tank mixes that may contribute to the potential risk.

To reduce the potential for negative impacts to aquatic organisms, BLM land managers must follow all label instructions and abide by any warnings. Labels for both tank mixed products should be thoroughly reviewed, and mixtures with the least potential for negative effects should be selected, particularly when a mixture is applied in a manner that increases the potential for risk to nearby aquatic organisms.

Impacts by Alternative

The BLM proposes to treat riparian vegetation with the three new herbicides to improve habitat for fish and aquatic organisms on public lands. However, herbicide treatments can also lead to the harm or even death of fish and aquatic organisms. The following discusses the habitat benefits and health risks to fish and aquatic organisms under each alternative.

Alternative A – Continue Present Herbicide Use (No Action Alternative)

Under the No Action Alternative, the BLM would continue its ongoing vegetation treatments programs in the 17 western states with the 18 currently approved active ingredients. Approximately 932,000 acres would be treated annually, with approximately 10,000 acres of aquatic and riparian habitat treated.

The potential impacts to fish and other aquatic species under this alternative are discussed in the 2007 PEIS (USDOI BLM 2007a:4-90 to 4-91). Use of herbicides would result in some toxicological impacts to fish, with long term beneficial effects to fish through improvements to aquatic and riparian areas through removal of invasive species from these habitats.

The greatest risks to fish and other aquatic organisms would be associated with the use of diquat, triclopyr, and certain (non-aquatic) formulations of 2,4-D and glyphosate. However, many of the currently approved herbicides would have some level of risk to aquatic organisms under spill and accidental direct spray

exposure scenarios. Buffer distances specified in the 2007 PEIS would continue to be applied to herbicide treatments to protect aquatic species, and SOPs for mixing, handling, transporting, and applying herbicides would continue to be implemented to minimize the likelihood of accidental spills and direct spray into aquatic habitats.

The currently approved herbicides include active ingredients that would continue to be used to manage invasive aquatic plant species such as Eurasian watermilfoil and water-thyme, species that alter riparian habitats such as common reed, saltcedar, and Japanese knotweed, and rangeland species that increase the risk of fire and associated sedimentation into aquatic habitat, such as cheatgrass. Treatment programs to improve riparian and aquatic habitats would continue under the No Action Alternative, which would be expected to benefit fish and other aquatic species.

Alternative B – Allow for Use of Three New Herbicides in 17 Western States (Preferred Alternative)

Under the Preferred Alternative, the amount of herbicide treatment on BLM-administered lands would be the same as under the No Action Alternative, but treatments could include use of aminopyralid, fluroxypyr, and rimsulfuron. The projected acreage of annual aquatic and riparian habitat treated with herbicides would also be the same as under the No Action Alternative, estimated at 10,000 acres.

As discussed previously, of the three new active ingredients none would be applied directly to the water column, although aminopyralid is likely to receive a registration that would allow for incidental overspray into aquatic habitats. None of the herbicides would be used to treat invasive aquatic plant species, but aminopyralid would be used in riparian treatments for selective removal of invasive riparian and wetland species. Fluroxypyr and rimsulfuron would most likely be used for spot treatments of certain target species.

Given that the three new herbicides have no risk to aquatic species (Table 4-10), their use in the BLM's vegetation management programs would be unlikely to have an adverse effect on aquatic species, and could result in a benefit to these species if they were used instead of active ingredients with more toxicological risk. As shown in Table 2-4, use of glyphosate, imazapic, and picloram would decrease by the greatest amount under this alternative. Of these, picloram and glyphosate both have a substantially greater toxicological risk to aquatic organisms than the three new active ingredients. Therefore, it is possible that aquatic organisms would be exposed to lower quantities of more harmful chemicals under this alternative.

As far as benefits to aquatic species through habitat improvements, effects under this alternative would be much the same as under the No Action Alternative. Invasive aquatic species would continue to be treated with the same chemicals as at present. The three new herbicides would be used in riparian and upland areas to target largely the same species as under the No Action Alternative.

Alternative C – No Aerial Application of New Herbicides

Nearly all (98 percent) of the targeted aquatic and riparian habitats are treated using ground-based methods. Therefore, prohibiting aerial applications of the three new herbicides under this alternative would have a minimal effect on the BLM's use of chemicals in and around these habitats, relative to the Preferred Alternative. Additionally, benefits to aquatic species from removal of invasive species in aquatic and riparian habitats would be similar to those under the other alternatives.

The projected breakdown of herbicides used would be slightly different than under the No Action and Preferred Alternatives. Use of glyphosate would decrease relative to the No Action Alternative, but not as much as under the Preferred Alternative. Use of picloram would be only slightly lower than under the No Action Alternative. Therefore, there could be a minor benefit to aquatic organisms through a reduction in toxicological risks associated with the use of glyphosate.

Alternative D – No Use of New Acetolactate Synthase-inhibiting Active Ingredients (No Rimsulfuron)

Under Alternative D, aminopyralid and fluroxypyr would be added to the list of approved active ingredients, but rimsulfuron would not. As rimsulfuron's use near aquatic habitats would be minimal under the other action alternatives, banning its use would have very little effect on treatment programs that affect habitats used by fish and other aquatic species. Similar to the other action alternatives, aminopyralid would be used near aquatic habitats for treatment of undesirable wetland and riparian plants that can impact fish and other aquatic organisms.

Rimsulfuron would not be used as an option for treating cheatgrass under this alternative, but imazapic would continue to be used to manage this species to reduce fire risk and prevent fire-related sedimentation into aquatic habitats. As both imazapic and rimsulfuron pose a very low risk to aquatic species, there would be little difference between Alternative D and the other action alternatives as far as toxicological risks. The breakdown of herbicide use under this alternative would be similar to the No Action Alternative, with only a slight decrease in the use of most active ingredients resulting from the addition of aminopyralid and fluroxypyr. The greatest decrease relative to the No Action Alternative would be in the use of metsulfuron methyl (3 percent), which has a low risk to aquatic species.

Mitigation for Herbicide Treatment Impacts

In order to protect non special status fish and aquatic invertebrates from potential toxicological effects associated with herbicide treatments, the BLM would continue to follow all applicable minimum buffer distances for aquatic habitats, as well as all SOPs for transport, handling, and application of herbicides. The mitigation measures specified in the 2007 PEIS (USDOI BLM 2007a:4-92) would also apply to treatments involving the new herbicides, including applications of tank mixes that include the currently approved herbicides.

Based on the results of ERAs, no additional buffers or other mitigation measures specific to aminopyralid, fluroxypyr, or rimsulfuron are warranted.

Special Status Fish and Other Aquatic Organisms

Introduction

As discussed in Chapter 3, BLM lands in the western U.S. support numerous aquatic animals that have been given a special status based on their rarity or sensitivity. Included are fish, mollusks, and aquatic arthropods that are federally-listed as threatened or endangered, or are proposed for federal listing. The *Vegetation Treatments Using Aminopyralid, Fluroxypyr, and Rimsulfuron on Bureau of Land Management Lands in 17 Western States Programmatic Biological Assessment* (USDOI BLM 2015) provides a description of the distribution, life history, and current threats of each federally listed aquatic species that could potentially be affected by the BLM's herbicide treatment programs, as well as species proposed for listing.

Impacts Assessment Methodology

Assessment of impacts to sensitive aquatic animal species followed the same general methodology that was developed for the 2007 PEIS (USDOI BLM 2007a:4-92 to 4-94). This methodology entailed following the protocol for completing ERAs that was developed with input from the USFWS, NMFS, and USEPA (ENSR 2004). The ERA methods for assessing impacts to aquatic organisms in general are summarized earlier in this section. To complete the ERA, a more conservative LOC of 0.05 (compared to an LOC of 0.5 for non special status species) was used to determine acute risks to special status fish and aquatic invertebrates. A more conservative LOC of 0.5 (compared to 1 for non special status species) was used to determine chronic risks.

Corresponding levels of risk (none, low, medium, or high) were obtained by determining the factor by which the RQ exceeded the LOC, and the number of modeled scenarios in which an exceedance occurred.

The results of the ERA analysis for two groups of aquatic organisms—special status fish and aquatic invertebrates—were used to determine the potential impacts to sensitive aquatic species, which are presented in the BA (USDOI BLM 2015). The analysis presented here incorporates the findings of the BA, and presents a comparison of the alternatives.

Summary of Herbicide Effects to Special Status Fish and Aquatic Invertebrates

A summary of the general effects of herbicide treatments on sensitive fish species and populations is presented in the 2007 PEIS (USDOI BLM 2007a:4-93 to 4-94). While the general toxicological risks to individual organisms of sensitive species would be the same as those predicted for non special status fish species, which were described earlier in this chapter, the associated population- and species-level effects could be much greater for many sensitive species because of their limited/fragmented distribution and limited population size.

In general, risks to special status fish and aquatic invertebrates from herbicide treatments would be

minimized by following applicable SOPs, which include the following:

- Survey for special status fish and aquatic invertebrate species before treating an area. Consider effects to special status species when designing herbicide treatment programs.
- Use drift reduction agents to reduce the risk of drift hazard.
- Select herbicide products carefully to minimize additional impacts from degradates, adjuvants, inert ingredients, and tank mixtures.
- Maintain appropriate buffer zones between treatment areas and water bodies with special status fish and aquatic invertebrates.
- Minimize treatments near water bodies during periods when fish and aquatic invertebrates are in the life stage most sensitive to the herbicide used.

Because the invasion and spread of non-native plant species in aquatic and riparian habitats affects certain populations of special status fish and aquatic invertebrates, herbicide treatments to control these species would benefit sensitive aquatic organisms by improving water quality and flow, and increasing dissolved oxygen. However, for most of the sensitive fish and other aquatic species analyzed in the BA, the primary threats to the species are changes in water levels and quality associated with development, upslope land use practices, groundwater pumping, and the expansion of non-native fish populations. For these species, the potential for water quality impacts associated with herbicide use may outweigh habitat improvements resulting from minimized invasive plant infestations.

The typical risk levels for special status aquatic animals associated with applications of the three new herbicides are presented in Table 4-11. As shown in the table, the risk level for all of the active ingredients are shown as 0, or “no risk,” which means that the majority of risk quotients are less than the LOC used for special status species. In the case of aminopyralid and rimsulfuron, no risks to sensitive fish and aquatic invertebrates were predicted under any of the modeled scenarios. In the case of fluroxypyr, there would be no risks associated with accidental direct spray of the active ingredient, but there would be a low risk to special status fish associated with a truck or helicopter spill of the active ingredient. Special status aquatic invertebrates could be at risk from a helicopter spill of fluroxypyr.

The BLM’s SOPs would minimize the risks of spills into aquatic habitats. Relevant SOPs include preparing a spill contingency plan in advance of treatments, mixing and loading herbicide products in an area where an accidental spill would not reach a water body, not rinsing spray tanks in or near water bodies, following product labels for use and storage, and requiring licensed applicators to apply the herbicides. Project design criteria also require the BLM to consider sensitive species that occur near potential treatment areas when developing site-specific vegetation treatment programs.

Impacts by Alternative

For the most part, the comparison of alternatives for special status fish and aquatic invertebrates is similar to that for all aquatic animals, which was presented earlier in this section. While risk levels associated with fluroxypyr are slightly higher for special status species than for non special status species, fluroxypyr treatments would make up only 1 percent or less of total herbicide use (across all habitat types; see Table 2-4) under all alternatives.

Alternative A – Continue Present Herbicide Use (No Action Alternative)

Under this alternative, the BLM would continue its vegetation treatment programs at current levels and with currently approved herbicides, with approximately 10,000 acres of aquatic and riparian habitats targeted for herbicide treatments annually. Programs would likely continue to include habitat restoration components that are specifically designed to improve habitat for sensitive species. Use of herbicides may be included in these programs.

Under this alternative, there would be some risk to sensitive aquatic species from use of herbicides, particularly the more toxic formulations, such as glyphosate.

TABLE 4-11
Risk Categories Used to Describe Herbicide Effects on Special Status Fish and Aquatic Invertebrates According to Exposure Scenario

Application Scenario	Aminopyralid		Fluroxypyr		Rimsulfuron	
	Typ[1]	Max[1]	Typ	Max	Typ	Max
Direct Spray/Spill						
Fish pond	0[2] [2:2]	0 [4:4]	0 [2:2]	0 [2:4]	0 [2:2]	0 [4:4]
Fish stream	0 [2:2]	0 [2:2]	0 [2:2]	0 [2:2]	0 [2:2]	0 [2:2]
Aquatic invertebrates pond	0 [2:2]	0 [4:4]	0 [2:2]	0 [3:4]	0 [2:2]	0 [4:4]
Aquatic invertebrates stream	0 [2:2]	0 [2:2]	0 [2:2]	0 [2:2]	0 [2:2]	0 [2:2]
Off-Site Drift						
Fish pond	0 [36:36]	0 [36:36]	0 [36:36]	0 [36:36]	0 [36:36]	0 [36:36]
Fish stream	0 [36:36]	0 [36:36]	0 [36:36]	0 [36:36]	0 [36:36]	0 [36:36]
Aquatic invertebrates pond	0 [36:36]	0 [36:36]	0 [36:36]	0 [36:36]	0 [36:36]	0 [36:36]
Aquatic invertebrates stream	0 [36:36]	0 [36:36]	0 [36:36]	0 [36:36]	0 [36:36]	0 [36:36]
Surface Runoff						
Fish pond	0 [84:84]	0 [84:84]	0 [84:84]	0 [84:84]	0 [84:84]	0 [84:84]
Fish stream	0 [84:84]	0 [84:84]	0 [84:84]	0 [84:84]	0 [84:84]	0 [84:84]
Aquatic invertebrates pond	0 [84:84]	0 [84:84]	0 [84:84]	0 [84:84]	0 [84:84]	0 [84:84]
Aquatic invertebrates stream	0 [84:84]	0 [84:84]	0 [84:84]	0 [84:84]	0 [84:84]	0 [84:84]

[1] Typ = Typical application rate; and Max = Maximum application rate.
[2] Risk categories: 0 = No risk (majority of RQs < most conservative LOC for special status species). The Risk Category is based on the risk level of the majority of risk quotients observed in any of the scenarios for a given exposure group and receptor type. For some "no risk" exposure groups, RQs for one or more scenarios exceeded the applicable LOC. The reader should consult the risk tables in Chapter 4 of the ERAs (AECOM 2014a-c) to determine the specific scenarios that result in the displayed level of risk for a given receptor group.

Alternative B – Allow for Use of Three New Herbicides in 17 Western States (Preferred Alternative)

Under this alternative, the goals of vegetation treatment programs would be the same as under the No Action Alternative, including treatments that target restoration and improvement of special status aquatic species habitats. The total acreage of aquatic and riparian habitat treated annually would also be the same as under the No Action Alternative.

The 2007 PEIS indicates that the currently approved active ingredients with the greatest likelihood of impacting special status aquatic animals are diuron, picloram, and the more toxic formulation of glyphosate. With the addition of aminopyralid, fluroxypyr, and rimsulfuron under this alternative, use of glyphosate and picloram would decrease. Use of diuron would also decrease, but to a lesser degree (Table 2-4). Together, use of these three active ingredients would decrease by 12 to 13 percent. Therefore, overall risks to aquatic special status species would potentially be lower than under the No Action Alternative.

Alternative C – No Aerial Application of New Herbicides

Since few aerial applications target aquatic and riparian areas, this alternative is likely to be similar to Alternative B as far as benefits to aquatic habitats and risks to sensitive aquatic species. The three herbicides of concern (glyphosate, picloram, and diuron) would decrease by 5 to 6 percent. Therefore, there could be

some reduced toxicological risk to special status aquatic species relative to the No Action Alternative, but potentially less than under the Preferred Alternative.

Alternative D – No Use of New Acetolactate Synthase-inhibiting Active Ingredients (No Rimsulfuron)

Since rimsulfuron is not used extensively near aquatic habitats, prohibition of its use under this alternative would have little effect as far as impacts to special status aquatic species. Decrease in the use of glyphosate, picloram, and diuron would be 5 to 6 percent under this alternative. Therefore the potential for reduced risk to special status aquatic species would be similar to that under Alternative C, and potentially less than under the Preferred Alternative.

Mitigation for Herbicide Treatment Impacts

Mitigation to reduce the likelihood of impacts to special status fish and other aquatic species, as included in the ROD for the 2007 PEIS, would continue to be implemented, as would all SOPs and mitigation presented earlier in this section. These measures would be applied to the three new herbicides, as relevant. The *Biological Assessment for Vegetation Treatments Using Aminopyralid, Fluroxypyr, and Rimsulfuron on Bureau of Land Management Lands in 17 Western States* determined that given the low toxicity of the three new herbicides to aquatic special status species, likely uses of the herbicides, and SOPs for minimizing the risks for spills into aquatic habitats, no new conservation measures were necessary for herbicide treatments using aminopyralid, fluroxypyr, or rimsulfuron (USDOI BLM 2015). Therefore, no additional mitigation measures for special status aquatic animal species are warranted.

Wildlife Resources

Introduction

Public lands sustain an abundance and diversity of wildlife resources. Over 3,000 species of wildlife occur on public lands, and are dispersed over ecologically diverse and essential wildlife habitats Public lands are vital to big game, upland game, waterfowl, shorebirds, songbirds, raptors and hundreds of species of non-game mammals, reptiles, and amphibians (USDOI BLM 2012a).

The BLM manages vegetation to improve wildlife habitat—areas where basic needs such as food, shelter, water, reproduction, and movement are met. Plants are an important component of habitat, providing food and cover for wildlife. Food is a source of nutrients and energy, while good cover prevents the loss of energy by providing shelter from extremes in wind and temperature. Cover also affords protection from predators. Areas that have been impacted by invasive plants may support fewer native wildlife species than areas with intact native plant communities (Germano et. al. 2001). The important characteristics of wildlife habitat in the eight ecoregions that comprise the treatment area are presented in the 2007 PEIS (USDOI BLM 2007a:3-36 to 3-43). Invasive plants can change habitat conditions by altering the structure of plant communities, creating conditions that are unfavorable for native wildlife species. For example, in an area dominated by cheatgrass, fires are high in frequency and have fewer unburned patches than in native communities, and can result in the loss of plant species that provide value for habitat, such as certain types of sagebrush (Miller et al. 2011). Areas dominated by invasive plants may also become less suitable for animal species that have co-evolved with native plant community types (Olson 1999b).

This section begins with an assessment of risks to general wildlife, including insects, birds, and small and large mammals, and is followed by an assessment of risks to special status wildlife species. Initial discussion in this section focuses on the risks to wildlife health from the use of herbicides, followed by an assessment of the risks and benefits to wildlife from treating vegetation in each ecoregion using the three new active ingredients, followed by an assessment of impacts to wildlife under each alternative.

Scoping Comments and Other Issues Evaluated in the Assessment

Most scoping comments pertaining to wildlife resources addressed the benefits to wildlife from using one or more of the three new active ingredients. Respondents stated that these herbicides have lower toxicity to wildlife than some of the herbicides currently being used. They also noted that these herbicides could be used to control noxious weeds and invasive species that alter habitats used by threatened and endangered wildlife species. In particular, one comment addressed the use of rimsulfuron to control cheatgrass in order to maintain viable habitat for sage-grouse and other shrub-steppe species.

The BLM also received a scoping comment requesting that the PEIS address potential sub-lethal effects to wildlife from the herbicides, reduced breeding/survival of sensitive species, secondary cumulative effects, and other unintended effects.

Standard Operating Procedures

The 2007 PEIS identified standard operating procedures that minimize risks to wildlife from herbicide applications on public lands. These general procedures are designed to reduce the risk of unintended impacts to wildlife, and were taken into consideration when evaluating risks to wildlife from use of aminopyralid, fluroxypyr, and rimsulfuron:

- Use herbicides of low toxicity to wildlife.
- Use spot applications or low-boom broadcast applications, where possible, to limit the probability of contaminating non-target food and water sources, especially vegetation over areas larger than the treatment area.
- Conduct pre-treatment surveys for sensitive habitat and special status species within or adjacent to proposed treatment areas.
- Use timing restrictions (e.g., do not treat during critical wildlife breeding or staging periods) to minimize impacts to wildlife.

A complete list of SOPs can be found in the 2007 PEIS (USDOI BLM 2007a:Table 2-8). Additional mitigation that was developed for wildlife resources and incorporated into the ROD for the 2007 PEIS is specific to the currently approved herbicides, and therefore is not repeated here. These measures would be applicable, however, for tank mixes or formulations that combine currently approved active ingredients with the new active ingredients.

Impacts Assessment Methodology

The methods used to assess impacts to wildlife from the three new herbicides were the same as the methods described in the 2007 PEIS (USDOI BLM 2007a:4-99 to 4-100). A brief overview of the risk assessment process is provided here, with a more detailed methodology presented in the risk assessments (AECOM 2014a-c).

Risk Assessment Methodology

Wildlife receptors, representing different categories of terrestrial animal species, were evaluated to determine the effects of herbicide exposure in terms of certain assessment endpoints and associated measures of effect. The assessment endpoint is an expression of the value that is to be protected. In the case of wildlife, assessment endpoints include mortality, growth, reproduction, and other ecologically-important sublethal processes. These assessment endpoints generally reflect direct effects on organisms, but indirect effects were also considered. Measures of effect are measurable changes in an attribute of an assessment endpoint (or its surrogate) in response to a stressor to which it is exposed (USEPA 1998b). For the ERAs, they generally consisted of acute and chronic toxicity data (from pesticide registration documents and from the available scientific literature) for the most appropriate surrogate species.

Because the BLM uses herbicides in a variety of programs with several different application methods, and because a range of wildlife species are found on public lands, the following exposure scenarios were considered to assess the potential ecological impacts of herbicides to wildlife under a variety of uses and conditions:

Direct spray of terrestrial wildlife:

- Small mammal – 100 percent absorption.
- Pollinating insect – 100 percent absorption.
- Small mammal – 1st order dermal absorption (absorption occurs over 24 hours, taking into consideration the potential for some herbicide to not be absorbed).

Indirect contact with foliage after direct spray:

- Small mammal – 100 percent absorption.
- Pollinating insect – 100 percent absorption.
- Small mammal – 1st order dermal absorption.

Ingestion of food items contaminated by direct spray:

- Small mammalian herbivore – acute and chronic exposure.
- Large mammalian herbivore – acute and chronic exposure.

- Small avian insectivore – acute and chronic exposure.
- Large avian herbivore – acute and chronic exposure.
- Large mammalian carnivore – acute and chronic exposure.

These exposure scenarios were considered as the most plausible routes for acute and chronic (short- and long-term) impacts under a variety of conditions. The selected receptors represent the range of wildlife species found on public lands, as well as the different feeding guilds that are present (herbivore, omnivore, and carnivore).

Exposure scenarios involving off-site drift, surface runoff, and wind erosion were not modeled for terrestrial wildlife because the direct spray scenarios were more conservative than scenarios involving wind erosion or runoff. Risk from consumption of food would be much greater if the food item was directly sprayed by an herbicide than if the herbicide drifted or was carried by water onto the food item.

Toxicological data for wildlife were extrapolated from data for representative or surrogate species. Data describing both acute and chronic effects were used to generate RQs for addressing potential risks to wildlife receptors (see the ERAs [AECOM 2014a-c] or the 2007 PEIS [USDOI BLM 2007a:4-100] for additional discussion of these calculations).

In order to address potential risks to wildlife receptors from exposure to herbicides, RQs were compared to levels of concern defined by the USEPA for screening the potential risk of pesticides. Distinct USEPA LOCs were used for acute and chronic risks, and for potential increased risks to special status species. For non special status wildlife, LOCs were 0.5 for acute risk and 1 for chronic risk. Wherever the RQ exceeded one or more of these LOCs, it was assumed that adverse toxicological effects to the wildlife group in question could occur. Corresponding levels of risk (low, medium, or high) were obtained by determining the factor by which the RQ exceeded the LOC.

Summary of Herbicide Impacts

The 2007 PEIS provides a discussion of the general risks to wildlife from herbicide use (USDOI BLM 2007a:4-101 to 4-102). Possible adverse direct effects include death, damage to vital organs, change in body weight, decrease in healthy offspring, and increased susceptibility to predation. Possible indirect effects include a reduction in availability of preferred food, habitat, and breeding areas; decrease in wildlife population densities within the first year following application as a result of limited reproduction; habitat and range disruption (as wildlife may avoid sprayed areas for several years following treatment), resulting in changes to territorial boundaries and breeding and nesting behaviors; and increase in predation of small mammals due to loss of ground cover (USEPA 1998c). Habitat modification is often the main risk to wildlife from herbicide use.

This effects analysis focuses on the effects of the three active ingredients proposed for use, in terms of toxological effects to wildlife, effectiveness at controlling invasive species and improving habitat, and potential adverse effects to habitat.

As discussed in the 2007 PEIS, species that reside in an area year-round and have a small home range (e.g., insects, small mammals, and territorial birds) would be more at risk for adverse effects than more mobile species. In addition, species feeding on animals that have been exposed to high levels of herbicide could be impacted, particularly if the herbicide bioaccumulates in their systems. Although these scenarios were not modeled, wildlife could also experience greater impacts in systems where herbicide transport is more likely, such as areas where herbicides are aerially sprayed, dry areas with high winds, or areas where rainfall is high and soils are porous. Wildlife that inhabit subsurface areas (e.g., insects and burrowing mammals) may also be at higher risk if soils are non-porous and herbicides have high soil-residence times. The degree of interception by vegetation, which depends on site and application characteristics, would also affect direct spray impacts. The impacts of herbicide use on wildlife would primarily be site- and application-specific, and as such, site assessments would have to be performed at the field level, using available impact information, to determine an herbicide-use strategy that would minimize impacts to wildlife, particularly in habitat that supports special status species.

Based on risk assessments, aminopyralid, fluroxypyr, and rimsulfuron generally have very low risk to wildlife, and the most substantial effects would be associated with habitat modification.

Impacts of Aminopyralid

Aminopyralid would commonly be used on rangelands to manage undesirable broadleaf species. Therefore, wildlife most likely to be exposed to this active ingredient would include those that inhabit or feed on grasslands and grass-dominated shrublands, such as ground-nesting birds, ground-dwelling mammals, and large mammals that forage in these habitats, such as deer, elk, and pronghorn.

The risk assessment for aminopyralid predicted that exposure to this active ingredient would not pose a risk to terrestrial wildlife under any of the modeled exposure scenarios (Table 4-12). Risk quotients were all below the LOC of 0.5 (acute high risk). Therefore, exposure of wildlife to this active ingredient by direct spray, contact with sprayed vegetation, or ingestion of plant materials or prey items that have been exposed to this active ingredient is not a concern from a toxicological perspective.

The invasive species targeted by aminopyralid treatments, such as yellow starthistle, knapweeds, thistles, and tansy ragwort generally provide minimal value to wildlife, and are detrimental to wildlife habitats by forming monocultures that displace native species. Therefore treatments that target these species should benefit wildlife by improving habitat. The degree of benefit would vary by species of wildlife. Elk, for example, are adversely affected by spotted knapweed because they prefer the native grasses that it displaces, while deer are less affected because they eat more shrubs and other browse (Utah State University 2014). In grass-dominated habitats, aminopyralid has been shown to benefit ground-nesting birds and ground-dwelling mammals by controlling invasive broadleaf species while stimulating development of native grass species (Green et al. 2011; Halstvedt et al. 2011; Harrington et al. 2011).

TABLE 4-12
Risk Categories Used to Describe Herbicide Effects on Non Special Status Wildlife According to Exposure Scenario

Application Scenario	Aminopyralid		Fluroxypyr		Rimsulfuron	
	Typ[1]	Max[1]	Typ	Max	Typ	Max
Direct Spray of Terrestrial Wildlife						
Small mammal – 100% absorption	0[2]	0	0	0	0	0
Pollinating insect – 100% absorption	0	0	0	0	0	0
Small mammal – 1st order dermal adsorption	0	0	0	0	0	0
Indirect Contact with Foliage After Direct Spray						
Small mammal – 100% absorption	0	0	0	0	0	0
Pollinating insect – 100% absorption	0	0	0	0	0	0
Small mammal – 1st order dermal absorption	0	0	0	0	0	0
Ingestion of Food Items Contaminated by Direct Spray						
Small mammalian herbivore – acute exposure	0	0	0	0	0	0
Small mammalian herbivore – chronic exposure	0	0	0	0	0	0
Large mammalian herbivore – acute exposure	0	0	0	0	0	0
Large mammalian herbivore – chronic exposure	0	0	0	0	0	0
Small avian insectivore – acute exposure	0	0	0	0	0	0
Small avian insectivore – chronic exposure	0	0	0	0	0	0
Large avian herbivore – acute exposure	0	0	0	0	0	0
Large avian herbivore – chronic exposure	0	0	0	0	0	0
Large mammalian carnivore – acute exposure	0	0	0	0	0	0
Large mammalian carnivore – chronic exposure	0	0	0	0	0	0

[1] Typ = Typical application rate; and Max = Maximum application rate.
[2] Risk categories: 0 = No risk (RQ < applicable LOC for non special status species).

As discussed in the Vegetation section, aminopyralid poses a risk to non-target native forbs and other desirable species in treatment areas, and therefore may have an adverse effect on wildlife habitats. Depending on the type of wildlife habitat and the size of the treatment area, temporary loss of herbaceous vegetation could have a short-term effect on broadleaf vegetation used by wildlife for food, cover, or nesting. Many native forbs, for example, provide important forage for wildlife, and may provide seeds that have higher energy content than foods provided by grass species (Kansas State University 1991). Native forbs also provide sources of pollen and nectar for certain native species of arthropods, and may serve as larval host plants.

In general, the long-term effects of removing invasive species from rangelands through aminopyralid applications would be to benefit native plant communities, improving wildlife habitat for numerous species in target areas.

Impacts of Fluroxypyr

Fluroxypyr would be used in very small quantities in the BLM's treatment programs, accounting for 1 percent or less of all herbicide treatment acres annually. Like aminopyralid, fluroxypyr would be used extensively in rangeland habitats, often in tank mixes, to manage invasive plants while maintaining grass forage species. Wildlife most likely to be exposed to this active ingredient would include inhabitants of grasslands and grass-dominated shrublands, including ground-nesting birds and ground-dwelling mammals. Large mammals that forage in these habitats would also have the potential to be impacted. Fluroxypyr would help manage invasive species that have developed a resistance to other herbicide active ingredients. Annual kochia and pricklypear are two of the target rangeland species identified by the BLM for this active ingredient. Both of these species provide some value for wildlife.

The risk assessment for fluroxypyr predicted that exposure to fluroxypyr would not pose a risk to terrestrial wildlife under any of the modeled exposure scenarios (Table 4-12). Risk quotients were all below the LOC of 0.5 (acute high risk). Therefore, exposure of wildlife to this active ingredient by direct spray, contact with sprayed vegetation, or ingestion of plant materials or prey items that have been exposed to this active ingredient is not a concern from a toxicological perspective.

One identified use of fluroxypyr is to control pricklypear in desert habitats. Pricklypear provides shelter and food for a wide variety of wildlife species, including nesting habitat for birds, reptiles, and small mammals, and cover for northern bobwhite. Its fruits, seeds, and pads provide food for numerous species, including white-tailed deer and collared peccary (Ueckert 1997). Therefore, use of fluroxypyr to control pricklypear could have adverse impacts to certain wildlife, depending on the species and the intent of the treatment.

Impacts of Rimsulfuron

Rimsulfuron could potentially see widespread use on public lands, depending on which alternative is selected, primarily for management of cheatgrass, medusahead rye, and other invasive winter annual grasses. This active ingredient would be used in a variety of wildlife habitats currently degraded by invasive plants, including (but not limited to) grasslands, sagebrush-steppe, and woodlands. The goals of these treatments would be to both reduce the cover of the target species and reduce the risk of future wildfire. Given its widespread use, a wide variety of wildlife could be exposed to this active ingredient.

Possible modes of wildlife exposure to rimsulfuron include direct spray, dermal contact with treated vegetation, and ingestion of plant materials or prey items that have been exposed to the active ingredient. The risk assessment for rimsulfuron predicted that none of these exposure scenarios would pose a risk to any type of terrestrial wildlife (Table 4-12). Risk quotients were all below the LOC of 0.5 (acute high risk). Therefore, use of rimsulfuron on public lands does not present a toxicological concern for wildlife.

Because rimsulfuron would often be used to target large monocultures of cheatgrass and other invasive species, the short-term result of applications would likely be loss of vegetation and associated cover in treatment areas, which may constitute an impact to key habitat components for wildlife species. These short-term impacts should be offset by long-term improvements to habitat if treatment programs effectively reduce cover of target plant species and promote the establishment of native plant species. In some cases, post-treatment rehabilitation may be required.

While wildlife habitats on public lands have been adversely affected by displacement of native species by winter annual grasses, and associated reduced productivity, a potentially greater impact to wildlife habitats is the role of invasive plants in increasing the frequency and size of wildfires (Johnson and Davies

2012). Species like cheatgrass and medusahead rye form a dense layer of litter that decomposes slowly and is highly flammable (Pellant 1996, Johnson and Davies 2012). Therefore, even in situations where these target species offer some value as forage to wildlife, they increase the amount of fine fuels, resulting in hot, frequent wildfires. The invasion of cheatgrass onto the Intermountain rangelands, for example, has resulted in destructive wildfires that have negatively impacted wildlife and grazing resources (Clements et al. 2012; Clements and Harmon 2013). In addition to directly harming wildlife and their nests and food sources, and displacing them from burned habitats, fires can result in the long-term loss of key wildlife habitat components, such as big sagebrush.

The BLM currently uses approved active ingredients to control invasive annual grasses. The addition of rimsulfuron would offer the BLM more herbicide options for targeting these invasive species. Additionally, as discussed previously, there is some evidence that rimsulfuron may be less harmful to non-target species and promote the reestablishment of desirable native species. Therefore, use of rimsulfuron would likely provided some level of long-term benefit to wildlife habitat.

Impacts of Herbicide Treatments on Wildlife and Habitat by Ecoregion

The 2007 PEIS gives a description of impacts to wildlife habitat from herbicide treatment programs, by ecoregion (USDOI BLM 2007a:4-109 to 4-114). These discussions focus on treatment goals in each ecoregion, and how herbicide treatments to meet those goals could impact wildlife and their habitats found in each ecoregion. As the goals of herbicide treatments and the assumptions of future treatments identified by local BLM offices during preparation of the 2007 PEIS carry over to this PEIS, the wildlife impacts by ecoregion are still applicable and are not repeated here. The discussion in this section focuses on new information since the 2007 PEIS, and how use of aminopyralid, fluroxypyr, and rimsulfuron might change the way that herbicide treatment programs impact wildlife and their habitat in each ecoregion.

Tundra and Subarctic

Herbicides have not been used on public lands in Alaska on Arctic tundra or in subarctic forests, and herbicide treatments were not proposed for these regions as part of the BLM's vegetation treatment programs during preparation of the 2007 PEIS. However, the BLM has since come out with a *Draft Dalton Management Area Integrated Invasive Plant Strategic Plan* (USDOI BLM 2009c), which addresses control of invasive plants along the Dalton Highway and adjacent BLM-administered lands, along trails and spur roads, and at other heavy use areas (e.g., gravel pits, rest stops, mine sites, and airstrips). The release of this document indicates that some herbicide treatments are likely to occur in Alaska over the next 10 years, primarily to stop the spread of invasive plants from disturbed sites.

Based on the current information, herbicide treatments (including the currently approved herbicides and the three new herbicides) would have a minimal effect on wildlife and their habitats. The proposed uses of herbicides in these ecoregions are largely localized to roadsides and other areas subject to ongoing human disturbance, which are not prime habitat for wildlife (USDOI BLM 2013i). Furthermore, early control of new invaders will prevent the spread of these species into more pristine areas, thereby minimizing the risk of future impacts to wildlife habitats associated with noxious weeds and other invasive plant species. A total of 19 invasive plant species have been targeted for control in Alaska, including the nitrogen fixers white sweetclover, alfalfa, bird's-foot trefoil, and bird vetch, which could alter ecosystem processes and wildlife habitats in naturally nitrogen-poor habitats.

Temperate Desert

The Temperate Desert Ecoregion would continue to receive the vast majority of herbicide treatments (an estimated 71 percent), with the goal of most treatments to restore lands damaged by fires in the Great Basin, and to benefit sage-grouse and other wildlife that use sagebrush communities.

Rimsulfuron, in particular, would be used extensively in the Temperate Desert Ecoregion, as a tool for controlling winter annual grasses such as cheatgrass and medusahead rye. Additionally, aminopyralid and fluroxypyr would be used, often in tank mixes with currently approved herbicides, to manage broadleaf rangeland weeds such as yellow starthistle, knapweeds, and annual kochia. Treatments with these herbicides would benefit a wide range of wildlife through habitat improvements with long-term goals of restoring native plant communities and reducing wildfire risk. Multiple treatments and post-treatment reseeding/restoration of native species would be necessary to meet these goals. Wildlife that would benefit from these treatments would include sage-grouse and shrub-dependent species. There

are roughly 200 species of wildlife in the Great Basin (USDOI BLM 1999), many of which would likely benefit from herbicide treatments in the Temperate Desert Ecoregion.

Subtropical Desert

Treatments in the Subtropical Desert Ecoregion would continue to make up a small fraction (less than 1 percent) of the planned herbicide treatments. Therefore use of all herbicides, including the three new herbicides, would be minimal. Herbicide treatments in this ecoregion would continue to focus on managing woody species that have invaded shortgrass and mixed-grass prairies of the desert southwest, including species such as mesquite, creosotebush, and snakeweed. These treatments benefit grassland-dwelling wildlife, such as jackrabbits, antelopes, and quail, by removing shrubs that have invaded these habitats and providing more open conditions (Germano 1978 *cited in* USDOI BLM 1991). For species that utilize shrubbier habitats, such as white-tailed deer, doves, and cottontail (McCormick 1975 *cited in* USDOI BLM 1991), herbicide treatments to control invading shrubs could have a negative effect on habitat.

Neither aminopyralid nor rimsulfuron has activity on the woody species that would be targeted for management in the Subtropical Desert ecoregion. Therefore, these herbicides would have little impact on wildlife habitats in this ecoregion. Fluroxypyr, however, provides control of undesirable woody species such as snakeweed and pricklypear, and could be used in limited amounts to control these species in the Subtropical Desert Ecoregion. Only a very small amount of this active ingredient would likely be used annually.

Temperate Steppe

Herbicide treatments in the Temperate Steppe Ecoregion would represent approximately 16 percent of all treated acres. More than three quarters of the herbicide treatments in this ecoregion would focus on management of invasive grasses and forbs, including cheatgrass, leafy spurge, and several species of knapweeds and thistles. Much of this work would be done in support of the BLM's Conservation of Prairie Grasslands initiative, and would benefit wildlife that inhabits short- and mixed-grass prairie grasslands, such as lesser prairie-chicken, mountain plovers, and prairie dogs.

Rimsulfuron is likely to be applied in wildlife habitats in this ecoregion because its predominant use would be control of cheatgrass. Aminopyralid has activity on knapweeds and thistles, and would provide the BLM with another option for management of these noxious weeds that alter the structure and species composition of prairie grasslands. Fluroxypyr would be used only minimally, but would be one option for controlling leafy spurge. While the BLM would be able to manage all of these invasive species with the currently approved active ingredients, the availability of aminopyralid would allow additional herbicide options when designing treatment programs to benefit wildlife habitats in the Temperate Steppe Ecoregion.

Subtropical Steppe Ecoregion

Herbicide treatments in the Subtropical Steppe Ecoregion would account for approximately 9 percent of all treatment acres. More than three-quarters of the treatments would occur in sagebrush and other shrub habitats, and 12 percent would occur in pinyon-juniper and other woodlands.

In sagebrush and pinyon-juniper communities, rimsulfuron would be available for use as another option for controlling infestations of cheatgrass and other winter annual grasses, and helping to reduce wildfire risk. Therefore, this active ingredient could be used instead of currently approved herbicides (primarily imazapic) in certain situations. None of the new herbicides, however, would play a role in treatments to thin sagebrush, pinyon and juniper, or other woody species in this ecoregion. Some control of broadleaf weeds could be offered by aminopyralid and rimsulfuron. Treatments with the new herbicides to control invasive plant species and reduce wildfire risk would provide a benefit to wildlife habitat.

Mediterranean and Marine Ecoregions

Herbicide treatments in the Mediterranean and Marine Ecoregions would represent approximately 5 percent of all treated areas. More than three-quarters of the treatments in these ecoregions would occur in forested habitats, and would be focused on integrated weed management and forest health. The objectives of forest health treatments would be to stem the decline in older forest habitats primarily due to fire exclusion, to restore more natural fire regimes, and reduce hazardous fuels to reduce the potential for catastrophic wildfires.

In forest and woodland habitats, the three new herbicides would be used to manage herbaceous invasive plant species that occur in the understory, or in canopy openings or disturbed areas, such as cheatgrass, knapweeds, and thistles. These treatments would be expected to improve habitat for forest- and woodland-dwelling wildlife by removing species that offer limited habitat value and displace higher value native forbs and grasses. Control of fire-adapted annual grasses in the understory would also help reduce fire risk in these habitats.

Impacts by Alternative

The following sections detail the expected effects of each of the four alternatives on terrestrial wildlife, and compare these effects to those expected under the other alternatives. These effects may vary depending on the percentage of acres treated using different application methods and different herbicides, as well as the size of treatment events. Earlier in this section, SOPs were described that would reduce some of the impacts described below.

Alternative A – Continue Present Herbicide Use (No Action Alternative)

Under the No Action Alternative, the BLM would continue its ongoing vegetation treatment programs in 17 western states, using the 18 active ingredients currently approved for use. As estimated in the 2007 PEIS, approximately 7 percent of all treatment acres are associated with vegetation treatments that are done specifically to benefit wildlife and their habitats. All treatments, however, would be likely to benefit wildlife habitats, as discussed in the previous section. A discussion of the benefits and impacts to wildlife is presented in the 2007 PEIS (Alternative B; USDOI BLM 2007a:4-115 to 4-116).

As identified in the 2007 PEIS, the currently approved herbicides of greatest concern to wildlife are 2,4-D, bromacil, diquat, and diuron, based on their relative level of risk to wildlife as predicted by ERAs. Based on the projections made in Table 2-4, treatments with these four active ingredients would comprise only about 10 percent of all acres treated under this alternative (compared to historic usage of about 13 percent). Other currently approved herbicides may pose low to moderate risk to wildlife under certain exposure scenarios.

Alternative B – Allow for Use of Three New Herbicides in 17 Western States (Preferred Alternative)

Under this alternative, the total acreage of wildlife habitat treated with herbicides would be the same as under the No Action Alternative and the other action alternatives. Therefore the degree of benefit to wildlife from treatment programs would be expected to be similar under all alternatives. The target species would be the same as under the No Action Alternative, as would treatment goals, including goals to improve wildlife habitat. The ability to use aminopyralid, fluroxypyr, and rimsulfuron under this alternative would allow the BLM greater flexibility in designing treatment projects, which could have a minor benefit to wildlife if it translates to more effective treatments and better achievement of project goals. The new active ingredients would provide new tools for controlling invasive species that may be resistant to one or more of the currently approved herbicides. Additionally, rimsulfuron would offer another option for wide-scale cheatgrass treatment, which currently threatens shrub-steppe and other important wildlife habitats throughout much of the western U.S.

Under this alternative, use of 2,4-D, bromacil, diquat, and diuron, when added together, would make up roughly 8 percent of all acres treated. Their usage would be slightly lower than under the No Action Alternative. However, all three of the new active ingredients proposed for use are of lower risk to wildlife than nearly all of the other active ingredients currently approved for use. Therefore, toxicological risks to wildlife would be lower overall under this alternative than under the No Action Alternative.

Alternative C – No Aerial Application of New Herbicides

Under this alternative, the total acreage of wildlife habitat treated with herbicides would be the same as under the other alternatives. Therefore, the degree of benefit to wildlife from treatment programs would be expected to be similar to those under the other alternatives. Since the new herbicides would not be applied using aerial methods, their use would be limited to ground-based treatments. As a result, currently approved active ingredients would continue to be used in herbicide treatments that improve wildlife habitats through large-scale control of invasive plants. The

degree of benefit to wildlife habitat could be slightly lower than under the Preferred Alternative if the effectiveness of treatment programs is limited by the inability to utilize the new herbicides under aerial spraying scenarios.

The BLM may need to continue to use herbicides with a greater toxicological risk to wildlife instead of the three new herbicides proposed for use. Under this alternative, use of 2,4-D, bromacil, diquat, and diuron, when added together, would make up roughly 9 percent of all acres, which is slightly less than under the No Action Alternative, and slightly greater than under the Preferred Alternative. Both glyphosate and picloram, which would have greater use under this alternative than under the Preferred Alternative, have a greater toxicological risk to wildlife than the three new herbicides. Risks to wildlife from exposure to herbicides would be greater than under the Preferred Alternative but less than under the No Action Alternative.

Alternative D – No Use of New Acetolactate Synthase-inhibiting Active Ingredients (No Rimsulfuron)

Under this alternative, the total acreage of wildlife habitat treated with herbicides would be the same as under the other alternatives, and the degree of benefit to wildlife from treatment programs would be similar under all alternatives. The inability to use rimsulfuron under this alternative would remove one option for treatment of invasives such as cheatgrass and other annual grasses. Control of these target species to improve wildlife habitat would continue with currently approved herbicides (such as imazapic). However, the effectiveness of treatments in certain areas could be lower than under the other action alternatives, particularly the Preferred Alternative.

Under this alternative, the currently approved active ingredients with the greatest toxicological risk to wildlife (2,4-D, bromacil, diquat, and diuron), when added together, would make up roughly 8 percent of all acres treated, which is the same as under the Preferred Alternative, and slightly lower than under the No Action Alternative and Alternative C. Relative to the Preferred Alternative, use of glyphosate and imazapic would be higher, similar to levels under the No Action Alternative. Relative to rimsulfuron, imazapic is of a similar toxicity to wildlife, so there would be little difference from a toxicological risk standpoint between the use of these two chemicals. Glyphosate, however, has a greater toxicological risk to wildlife than rimsulfuron. Therefore, risks to wildlife associated with exposure to herbicides could be slightly greater under this alternative than under the Preferred Alternative.

Mitigation for Herbicide Treatment Impacts

The BLM would continue to implement the SOPs identified earlier in this section, as well as all other SOPs identified in the 2007 PEIS (USDOI BLM 2007a: Table 2-8). These include, but are not limited to, timing restrictions to avoid critical wildlife breeding or staging periods and pre-treatment surveys for sensitive wildlife and their habitats. The mitigation measures for wildlife specified in the 2007 PEIS (USDOI BLM 2007a:4-118) would also apply to treatments involving the new herbicides, including applications of mixtures of the new herbicides with currently approved herbicides.

Given the low toxicological risk of aminopyralid, fluroxypyr, and rimsulfuron to wildlife, no new mitigation measures have been developed specific to these active ingredients.

Special Status Wildlife Species

Introduction

As discussed in Chapter 3, public lands in the western U.S. support over 200 species of terrestrial wildlife (including birds, mammals, amphibians, reptiles, mollusks, and arthropods) that have been given a special status based on their rarity or sensitivity. Included are more than 60 species that are federally listed as threatened or endangered, or are proposed for federal listing. Some of these species have habitat requirements that have been or are being altered or reduced by invasions of non-native plant species. The *Vegetation Treatments Using Aminopyralid, Fluroxypyr, and Rimsulfuron on Bureau of Land Management Lands in 17 Western States Biological Assessment* (USDOI BLM 2015) provides a description of the distribution, life history, and current threats for each federally listed animal species, as well as species proposed for listing. The BA also discusses the risks to federally listed and proposed terrestrial wildlife associated with each of the herbicides proposed for use by the BLM under the different alternatives.

Impacts Assessment Methodology

The BLM reviewed the literature and findings from ERAs conducted by the BLM to assess the impacts to

sensitive wildlife species from the use of herbicides (AECOM 2014a-c). The ERA methods are summarized in the Wildlife Resources section of this chapter, and are presented in more detail in the *Vegetation Treatments Programmatic EIS Ecological Risk Assessment Protocol* (ENSR 2004) and in Appendix C of the 2007 PEIS. To complete risk assessments for special status wildlife species, the chronic risk LOC of 1 and the acute endangered species LOC of 0.1 were used.

Summary of Herbicide Effects to Special Status Wildlife Species

A summary of the general effects of herbicide treatments on special status wildlife species and populations is presented in the 2007 PEIS (USDOI BLM 2007a:4-119 to 4-120). Use of herbicides can affect the habitats of special status wildlife species, as discussed for wildlife in general. Herbicide treatments would be expected to benefit species that are threatened because of noxious weeds and other invasive plant species. Invasive plant species typically reduce the prevalence of native plant species, many of which serve as the preferred food (or in some cases the only food) of special status wildlife species. Invasive species may also detrimentally affect other important habitat components such as structure for nesting, foraging, and cover. Herbicide treatments that reduce the cover of non-native species and increase the cover of native species would be expected to benefit these special status wildlife species.

Potential adverse effects to the habitat of special status wildlife species from herbicide treatments include removal of vegetation used for cover, nesting, or food, including unintentional removal of larval host plants and nectar sources for listed butterfly species.

The three new herbicides proposed for use by the BLM could pose toxicological risks to special status wildlife as a result of exposure via various pathways (direct spray, contact with foliage after direct spray, and ingestion of food items contaminated by direct spray). Based on information presented in the ERAs, aminopyralid and rimsulfuron would not pose toxicological risks to any special status wildlife under the modeled exposure scenarios. In the case of applications involving fluroxypyr, there would be a low risk to pollinating insects as a result of direct spray scenarios. This is a conservative scenario that assumes the insect absorbs 100 percent of the herbicide, with no degradation or limitations to uptake.

The potential for special status wildlife and their habitats to be exposed to herbicide treatments involving herbicides would be minimized by following applicable SOPs, which include the following:

- Survey for special status wildlife species before treating an area. Consider effects to these species when designing treatment programs.
- Use drift reduction agents to reduce the risk of drift hazard.
- Select herbicide products carefully to minimize additional impacts from degradates, adjuvants, inert ingredients, and tank mixtures.
- Avoid treating vegetation during time-sensitive periods (e.g., nesting and migration) for species of concern in the area to be treated.

Herbicide treatments would adhere to the most recent guidance for special status species, including land use plan decisions for sage-grouse as amended by pertinent sage-grouse EISs, and interim management direction as outlined in Instruction Memorandum 2012-043 (*Greater Sage-Grouse Interim Management Policies and Procedures*).

Impacts by Alternative

For the most part, the comparison of alternatives for special status wildlife is similar to that for all terrestrial wildlife, presented earlier in this chapter. While risk levels associated with fluroxypyr (presented in Table 4-13) are slightly higher for special status species than for non special status species, fluroxypyr treatments would make up only 1 percent or less of total herbicide use under all alternatives, and would only pose a risk to pollinating insects.

Alternative A – Continue Present Herbicide Use (No Action Alternative)

Under this alternative, the BLM would continue its treatment programs with the currently available herbicides, treating up to 932,000 acres annually. Some of the treatments would be implemented specifically to benefit special status species and their habitat.

Herbicides of greatest concern to special status wildlife from a toxicological perspective are 2,4-D, bromacil, diquat, diuron, glyphosate, hexazinone, and triclopyr. Based on their projected usage (summarized in Table 2-4), treatments with these active ingredients would total

TABLE 4-13
Risk Categories Used to Describe Herbicide Effects on Special Status Wildlife According to Exposure Scenario

Application Scenario	Aminopyralid		Fluroxypyr		Rimsulfuron	
	Typ[1]	Max[1]	Typ	Max	Typ	Max
Direct Spray of Terrestrial Wildlife						
Small mammal – 100% absorption	0[2]	0	0	0	0	0
Pollinating insect – 100% absorption	0	0	**L**	**L**	0	0
Small mammal – 1st order dermal adsorption	0	0	0	0	0	0
Indirect Contact with Foliage After Direct Spray						
Small mammal – 100% absorption	0	0	0	0	0	0
Pollinating insect – 100% absorption	0	0	0	0	0	0
Small mammal – 1st order dermal absorption	0	0	0	0	0	0
Ingestion of Food Items Contaminated by Direct Spray						
Small mammalian herbivore – acute exposure	0	0	0	0	0	0
Small mammalian herbivore – chronic exposure	0	0	0	0	0	0
Large mammalian herbivore – acute exposure	0	0	0	0	0	0
Large mammalian herbivore – chronic exposure	0	0	0	0	0	0
Small avian insectivore – acute exposure	0	0	0	0	0	0
Small avian insectivore – chronic exposure	0	0	0	0	0	0
Large avian herbivore – acute exposure	0	0	0	0	0	0
Large avian herbivore – chronic exposure	0	0	0	0	0	0
Large mammalian carnivore – acute exposure	0	0	0	0	0	0
Large mammalian carnivore – chronic exposure	0	0	0	0	0	0

[1] Typ = Typical application rate; and Max = Maximum application rate.
[2] Risk categories: 0 = No risk (RQ < applicable LOC for special status species); and L = Low risk (RQ 1-10 times the applicable LOC for special status species).

approximately 38 percent of all acres treated (compared to historic usage of about 44 percent). Out of these active ingredients, triclopyr, glyphosate, and 2,4-D would be used most widely, accounting for 33 percent of all acres treated. Other currently approved active ingredients may pose low to moderate risks to special status wildlife under a few exposure scenarios.

Alternative B – Allow for Use of Three New Herbicides in 17 Western States (Preferred Alternative)

Under this alternative, efforts to improve habitats that support special status wildlife would benefit from the addition of aminopyralid, fluroxypyr, and rimsulfuron to the list of approved herbicides. These herbicides may improve the effectiveness of certain treatments, relative to treatments using the currently approved herbicides. Therefore, the degree of benefit to special status species may be slightly greater than under the No Action Alternative in certain situations.

In certain treatment projects, herbicides of low toxicity to special status wildlife would be used instead of herbicides with a higher risk. In particular, use of glyphosate would decrease by more than half. Herbicides of greatest concern from a toxicological perspective would account for 30 percent of all acres treated, with use of 2,4-D, glyphosate, and triclopyr accounting for 26 percent of all acres treated. Therefore risks for adverse effects to special status wildlife associated with exposure to herbicides could be slightly lower than under the No Action Alternative.

Alternative C – No Aerial Application of New Herbicides

Under this alternative, treatments that improve special status wildlife habitats through large-scale control of invasive species would be accomplished using aerial spraying of currently approved herbicides, but not the new herbicides. This restriction would limit the benefits associated with introducing new herbicide options, relative to the Preferred Alternative.

Since the new herbicides would not be used in aerial applications, opportunities to use these active ingredients in place of those with a greater toxicological concern would be fewer than under the Preferred Alternative. Herbicides of greatest concern from a toxicological perspective would account for 35 percent of all acres treated, with use of 2,4-D, glyphosate, and triclopyr accounting for 31 percent of all acres treated. Depending on where these herbicides are used, risks to special status wildlife from exposure to herbicides could be slightly lower than under the No Action Alternative but slightly higher than under the Preferred Alternative.

Alternative D – No Use of New Acetolactate Synthase-inhibiting Active Ingredients (No Rimsulfuron)

Under this alternative, only two of the proposed active ingredients would be available for use under the BLM's herbicide treatment programs. Use of new active ingredients would be approximately the same as under Alternative C, although the breakdown by herbicide would be different. Programs aimed at improving habitat for special status wildlife species would be implemented without the option of rimsulfuron. The degree of benefit to special status species could be lower than under the Preferred Alternative if certain treatments are less effective without the option of rimsulfuron.

Under this alternative, based on herbicide usage estimates by the BLM, herbicides of greatest toxicological concern (2,4-D, glyphosate, and triclopyr) would account for 36 percent of all acres treated, very similar to the No Action Alternative. Therefore, risks for adverse effects to special status wildlife would be similar to the No Action Alternative and slightly higher that under the other action alternatives.

Mitigation for Herbicide Treatment Impacts

Mitigation to reduce the likelihood of impacts to special status wildlife species, as included in the ROD for the 2007 PEIS, would continue to be implemented under all alternatives, as would all SOPs and mitigation for general wildlife species presented earlier in this section. These measures would be applied to treatments with the three new herbicides, as relevant.

The *Biological Assessment for Vegetation Treatments Using Aminopyralid, Fluroxypyr, and Rimsulfuron on Bureau of Land Management Lands in 17 Western States* determined that given the low toxicity of the three new active ingredients to most special status species and SOPs for minimizing risks to wildlife, no new conservation measures were necessary for herbicide treatments using aminopyralid or rimsulfuron (USDOI BLM 2015). For terrestrial arthropods, however, the BA recommended a conservation measure specific to use of fluroxypyr. Therefore, the following mitigation is recommended to reduce the likelihood of impacts to special status terrestrial wildlife species from herbicide applications.

- When conducting herbicide treatments in or near habitat used by special status and listed terrestrial arthropods, design treatments to avoid the use of fluroxypyr, where feasible. If pre-treatment surveys determine the presence of listed terrestrial arthropods, do not use fluroxypyr to treat vegetation.

Additional evaluations of situation-specific effects to special status wildlife will occur prior to local implementation of vegetation management activities that involve the use of aminopyralid, fluroxypyr, and rimsulfuron. Additional measures to protect special status wildlife may be developed at that time.

Livestock

Introduction

Public lands provide an important source of forage for many ranches and help to support the agricultural component of many communities scattered throughout the West. Approximately 155 million acres of public lands are available to be grazed by livestock. Noxious weeds can affect the health of grazing lands by displacing native grasses and other plant species.

Additionally, certain noxious weeds are poisonous to livestock. Livestock that encounter noxious weeds may also contribute to the spread of noxious weeds on rangelands.

Scoping Comments and Other Issues Evaluated in the Assessment

Scoping comments directly pertinent to livestock and grazing included statements that the new herbicides are safe for use on grazing sites, and that aminopyralid in particular can be used in smaller amounts compared to currently approved herbicides.

A few comments, however, indicated that use of aminopyralid may be incompatible with grazing because of its persistence in vegetation. Comments noted incidents involving use of manure from animals that had grazed on vegetation treated with aminopyralid, which resulted in damage to crops and other non-target vegetation.

Standard Operating Procedures

The 2007 PEIS lists SOPs for minimizing risks to livestock, which can be implemented at the local level according to site conditions. These SOPs would apply to use of the new active ingredients, as applicable, to reduce potential unintended impacts to livestock from herbicide treatments:

- Whenever possible and whenever needed, schedule treatments when livestock are not present in the treatment area. Design treatments to take advantage of normal livestock grazing rest periods, when possible.
- As directed by the herbicide label, remove livestock from treatment areas prior to herbicide application, where applicable.
- Use herbicides of low toxicity to livestock, where feasible.
- Take into account the different types of application equipment and methods, where possible, to reduce the probability of contamination of non-target food and water sources.
- Notify permittees of the project to improve coordination and avoid potential conflicts and safety concerns during implementation of the treatment.
- Notify permittees of livestock grazing or feeding restrictions, if necessary (see below for restrictions associated with each herbicide).
- Notify adjacent landowners prior to treatment.
- Provide alternate forage sites for livestock, if possible.

The ROD for the 2007 PEIS (USDOI BLM 2007b: Table 2) also lists mitigation measures for livestock that are applicable to the currently approved herbicides. These measures could apply to the three new active ingredients if they are combined with one or more currently approved active ingredients in a formulation or tank mix.

SOPs and mitigation measures would help minimize impacts to livestock and rangeland on western BLM lands to the extent practical. As a result, long-term benefits to livestock from the control of invasive species would likely outweigh any short-term negative impacts to livestock associated with herbicide use.

Impacts Assessment Methodology

The methods used to assess impacts to livestock from the three new active ingredients were the same as those described in the 2007 PEIS (USDOI BLM 2007a:4-125). Risk assessment results pertaining to mammalian receptors were used to assess impacts to livestock from the three new herbicides. The ERA methods are summarized in the Wildlife Resources section of this chapter, with a more detailed methodology presented in the ERAs. For dermal exposure scenarios, small mammals were used as receptors, as they are more likely to be affected than large animals (larger surface area to body weight ratio) and the results are more conservative. For ingestion scenarios, a large mammalian herbivore (mule deer) was used as the receptor in the risk assessment.

Summary of Herbicide Impacts

The 2007 PEIS (USDOI BLM 2007a:4-125 to 4-126) provides a discussion of the general effects of herbicide use on livestock. This information is summarized here, with more detailed discussion included for the three active ingredients specifically covered by this PEIS.

Possible direct effects from herbicides include death, damage to vital organs, change in body weight, decreases in healthy offspring, and increased susceptibility to predation. However, these effects are largely dependent on the quantity of the herbicide and the sensitivity of livestock to the herbicide used. Possible indirect effects include reduction in the amount of forage and the preferred forage type.

Beneficial effects to livestock could include an increase in desirable forage and a decrease in noxious weeds and other invasive species that constitute undesirable forage. Additionally, treatments that reduce the risk of future catastrophic wildfire through fuels reduction would also benefit livestock. Invasive plant species that may present a fire hazard in rangelands include cheatgrass,

medusahead rye, other winter annual grasses such as ventenata and red brome, Russian thistle, oak, pinyon, and juniper.

Over the short term, there would be minor impacts to livestock rearing as a result of mandatory restrictions associated with the use of herbicides. These include restrictions on slaughter (for food) of animals that have consumed treated vegetation, as well as various grazing restrictions.

Noxious weed infestations can greatly reduce the land's carrying capacity for domestic livestock, which tend to avoid most weeds (Olson 1999a). Cattle, in particular, preferentially graze native plant species over weeds, which often have low palatability as a result of defenses such as toxins, spines, and/or distasteful compounds. In addition, some noxious weeds are poisonous to livestock. Although goats and sheep are more likely to consume alien weeds than cattle, they also tend to select native or introduced forage species over weeds (Olsen and Wallander 1997, Olson 1999a). The success of invasive plant species removal would determine the level of benefit of the treatments over the long term.

Livestock consume large amounts of grass, and therefore have a relatively greater risk for harm than animals that feed on other herbaceous vegetation or seeds and fruits, because herbicide residue is higher on grass than it is on other plants (Fletcher et al. 1994; Pfleeger et al. 1996). However, aminopyralid, fluroxypyr, and rimsulfuron generally have a very low risk to mammals, even when considering large herbivores and conservatively assuming that 100 percent of the animal's diet comes from treated vegetation. Therefore, the most likely effects would be associated with habitat modification and grazing restrictions.

Impacts of Aminopyralid

Aminopyralid is a selective herbicide that is used to control undesirable broadleaf plants in rangelands and pastures. Therefore it is likely to be used in areas grazed by livestock.

The risk assessment for aminopyralid predicted that none of the possible scenarios of aminopyralid exposure (direct spray, contact with foliage after direct spray, ingestion of food items contaminated by direct spray) would pose a risk of adverse effects to livestock. As discussed previously, even scenarios that assume 100 percent of the diet comes from treated vegetation indicated no risk to livestock.

While aminopyralid is unlikely to adversely affect survival, growth, or reproduction of livestock, some restrictions in grazing would be necessary with the use of aminopyralid. Persistent herbicides are a class of systemic herbicides that are used to control a wide variety of broadleaf species. These herbicides are formulated to survive multiple years of exposure in a growing environment. The BLM would follow all label instructions when using herbicides. Aminopyralid is persistent in vegetation and does not break down in plants (Dow AgroSciences 2005), and therefore may be present in the urine or manure of livestock that have grazed in aminopyralid-treated rangelands. Therefore, after grazing aminopyralid-treated forage, livestock must graze for 3 days in an untreated pasture without desirable broadleaf plants before returning to an area where desirable broadleaf plants are present. There are no other restrictions on grazing following application of aminopyralid at the proposed typical or maximum application rate. If aminopyralid is used in a mixture with one or more other active ingredients, additional grazing restrictions may apply.

As discussed in the Vegetation section, aminopyralid has been observed to be successful at controlling unpalatable and/or poisonous rangeland weeds, such as musk thistle, yellow starthistle, knapweeds, and tansy ragwort. Russian knapweed and yellow starthistle, for instance, are known to be toxic to horses, causing "chewing disease" if large quantities are grazed over time, which can result in death if not treated (Turner et al. 2011). Tansy ragwort is toxic to all kinds of livestock, but particularly to cattle and horses. Ingestion of this noxious weed causes liver toxicity, and can result in death of animals that graze in fields where tansy ragwort is present (USDA Agricultural Research Service 2006).

Successful removal of these noxious weeds and restoration of grasses and other more palatable forage species would be beneficial to livestock. Aminopyralid is selective for broadleaf weeds, and therefore would not harm the native grasses that are favorable as forage for livestock.

Many forbs have a higher nutritional value than grasses, even though forbs make up a small percentage of the total cattle diet (Weir et al 2004). Non-target broadleaf species that would be adversely affected by an application of aminopyralid could include some of the most nutritionally valuable forage plants for livestock production. Therefore, while use of aminopyralid in rangelands could reduce the cover of noxious weeds and other unpalatable species, it could also reduce the

amount of high quality forage (forbs) available to grazing animals (Weir et al. 2004).

Impacts of Fluroxypyr

Fluroxypyr is a selective herbicide that is used to control undesirable broadleaf plants while maintaining grass forage species. Therefore, fluroxypyr is likely to be used in rangelands that are grazed by livestock.

According to the risk assessment, fluroxypyr does not have a risk of causing adverse health effects to livestock as a result of dermal exposure or ingestion scenarios.

Fluroxypyr does not have any grazing restrictions for livestock, including lactating and non-lactating dairy animals. However, livestock must not eat treated forage for at least 2 days before slaughter for meat. If fluroxypyr is used in a mixture with one or more other herbicides, additional grazing restrictions may apply.

As discussed in the Vegetation section, fluroxypyr is effective at controlling pricklypear as well as other undesirable rangeland plants. Therefore, use of this herbicide could help improve the quality of rangeland forage, although its total annual use by the BLM would be low.

At high densities, pricklypear can interfere with forage utilization and livestock movement and handling. However, the fruits of the plant, in particular, are high in carbohydrates and very palatable to livestock. While the spines on plants are generally avoided, they may be ingested by hungry animals. Ingestion of spines can cause ulceration and bacterial infection of the mouthparts and gastrointestinal tracts of sheep and goats (Ueckert 1997). Therefore control of pricklypear could have either adverse or beneficial effects on livestock forage, depending on how much of the species is controlled and what other forage is present on the site.

Impacts of Rimsulfuron

Rimsulfuron is a selective herbicide that is used to control winter annual grasses, such as cheatgrass and medusahead rye. It is approved for use on rangelands, and therefore is likely to be used in areas grazed by livestock.

According to the ERA, rimsulfuron does not pose a risk to mammals under any of the modeled exposure scenarios. These include scenarios involving direct spray, indirect contact with foliage after direct spray, and ingestion of food that has been treated with the active ingredient.

The label for rimsulfuron products includes a grazing restriction for range and pasture areas. No livestock grazing should occur on treated sites for 1 year following application, to allow newly emerged grasses sufficient time to establish.

Winter annual grasses reduce the quality of forage for livestock by displacing native grasses, and providing a very limited grazing season. Medusahead rye is rich in silica and becomes unpalatable to cattle and sheep in late spring (Oregon Department of Agriculture 2013). The seeds of cheatgrass produce stiff awns that make the plant unpalatable once the seed has dried. In Nevada, for example, the cheatgrass grazing season for livestock is only 4 to 5 weeks (University of Nevada Cooperative Extension 1998). Native perennial grasses stay green longer than invasive annual grasses, thus extending the grazing season (Griffith 2004). Additionally, cheatgrass increases the risk of wildland fire in rangelands, which would potentially affect livestock grazing in these areas. Nonetheless, cheatgrass is utilized as a forage species for livestock (Emmerich et al. 1993).

Impacts by Alternative

The potential effects to livestock under each alternative are discussed in the following sections. There are few differences among the alternatives, as the extent of herbicide treatment generally would be the same, with only changes in the relative percent of herbicides used.

Alternative A – Continue Present Herbicide Use (No Action Alternative)

This alternative represents a continuation of current herbicide usage practices. The likely impacts of this alternative on livestock were presented in the 2007 PEIS, under the discussion for the Preferred Alternative (USDOI BLM 2007a:4-134; Tables 4-25 and 4-26). Both positive and negative effects to livestock are likely to continue under this alternative. Many of the currently approved herbicides are associated with some level of risk to livestock via one or more exposure pathways. The mitigation measures presented in the ROD for the 2007 PEIS (USDOI BLM 2007b:Table 2) would continue to be implemented to prevent adverse effects to livestock from herbicide applications in areas grazed by these animals.

Herbicide treatments under the No Action Alternative would continue to improve rangeland across the West. These treatments are controlling noxious weeds and limiting the risk of wildland fire, both of which should benefit livestock that use public lands. Multiple treatments and post-treatment reseeding/restoration of native species would be necessary to improve rangeland over the long term.

Alternative B – Allow for Use of Three New Herbicides in 17 Western States (Preferred Alternative)

Under this alternative, the same total acreage would be treated using herbicides as under the No Action Alternative, except that aminopyralid, fluroxypyr, and rimsulfuron would be added to the list of approved active ingredients. Addition of the new herbicides would result in a shift in the relative amounts of the various herbicides that are used. However, only glyphosate, imazapic, and picloram would have a substantial reduction in usage under this alternative. Glyphosate and picloram are associated with low to moderate risks to livestock under various exposure scenarios (USDOI BLM 2007a:Table 4-26), but there is no risk to livestock associated with use of imazapic (USDOI BLM 2007a:4-129). Approximately 7 percent fewer acres would be treated with herbicides that have some level of risk to livestock.

Availability of the new herbicides would allow the BLM more flexibility in designing treatment programs, and could result in more successful treatment of rangelands utilized by livestock. Additionally, the new herbicides could be used in rangelands where livestock mitigation measures from the 2007 PEIS restrict use of other herbicides, to more effectively control rangeland weeds.

Alternative C – No Aerial Application of New Herbicides

Under this alternative, the three new herbicides would not be able to be applied using aerial methods, and use of these chemicals would be lower than under the Preferred Alternative. Instead, other herbicides would be used for these large-scale treatments. As a result, approximately 5 percent fewer acres would be treated with herbicides that have some level of risk to livestock, relative to the No Action Alternative.

The BLM would be able to use the new herbicides in some areas where use of currently approved herbicides is limited by livestock mitigation measures from the 2007 PEIS, but not to the same degree as in Alternative B.

Alternative D – No Use of New Acetolactate Synthase-inhibiting Active Ingredients (No Rimsulfuron)

Under this alternative, aminopyralid and fluroxypyr could be applied in rangelands via any application method, but rimsulfuron would not be added to the list of approved herbicides. Glyphosate and imazapic would continue to be used instead under most circumstances. Glyphosate is of low to medium risk to livestock, but imazapic poses no risk to livestock through the modeled exposure scenarios. Similar to the Preferred Alternative, approximately 7 percent fewer acres would be treated with herbicides that have some level of risk to livestock, relative to the No Action Alternative. While the BLM would not have rimsulfuron available for cheatgrass treatment programs in rangelands, this invasive rangeland species would continue to be controlled using imazapic and other active ingredients.

Mitigation for Herbicide Treatment Impacts

The BLM would continue to implement the SOPs identified earlier in this section, as well as all other SOPs identified in the 2007 PEIS (USDOI BLM 2007a: Table 2-8). Additionally, the mitigation measures for livestock that were specified in the ROD for the 2007 PEIS (USDOI BLM 2007b:Table 2) would continue to be followed, as applicable.

Given their low toxicological risks, no mitigation measures for livestock have been proposed specifically for herbicide treatments with aminopyralid, fluroxypyr, or rimsulfuron.

Wild Horses and Burros

Introduction

Herbicide treatments have the potential to affect wild horses and burros on BLM-administered lands through exposure to chemicals that could harm their health, or through changes in vegetation that could positively or negatively alter the carrying capacity of HMAs. Adverse impacts could include direct harm to wild horses and burros and a reduction in the availability or quality of forage in HMAs (decreasing the carrying capacity of the HMAs). Alternately, herbicide treatments could improve the amount and quality of

forage, potentially increasing the carrying capacity of the HMAs.

Scoping Comments and Other Issues Evaluated in the Assessment

One scoping comment expressed concern about the toxicity of herbicides to wild horses and burros. No other scoping comments pertaining specifically to wild horses and burros were received.

Standard Operating Procedures

The 2007 PEIS lists SOPs for minimizing risks to wild horses and burros, which can be implemented at the local level according to specific conditions. These SOPs include the following:

- Use herbicides of low toxicity to wild horses and burros, where feasible.
- Remove wild horses and burros from identified treatment areas prior to herbicide application, in accordance with label directions for livestock.
- Take into account the different types of application equipment and methods, where possible, to limit the probability of contaminating non-target food and water sources.

The ROD for the 2007 PEIS (USDOI BLM 2007b: Table 2) also lists several mitigation measures for wild horses and burros that are applicable to the currently approved herbicides. These mitigation measures would be followed, as applicable, when using mixtures of currently approved herbicides and new herbicides. Additionally, the ROD specified that the herbicide label grazing restrictions for livestock should be applied to herbicide treatments in areas that support populations of wild horses and burros.

Impacts Assessment Methodology

The methods used to assess impacts to wild horses and burros from aminopyralid, fluroxypyr, and rimsulfuron were the same as those described in the 2007 PEIS (USDOI BLM 2007a:4-137). Risk assessment results pertaining to mammalian receptors were used to assess impacts to wild horses and burros. The ERA methods are summarized in the Wildlife Resources section of this chapter, with a more detailed methodology presented in the ERAs. For dermal exposure scenarios, small mammals were used as receptors, as they are more likely to be affected than large animals (larger surface area to body weight ratio) and the results are more conservative. For ingestion scenarios, a large mammalian herbivore (mule deer) was used as the receptor in the risk assessment.

Summary of Herbicide Impacts

The 2007 PEIS (USDOI BLM 2007a:4-137 to 4-138) provides a general discussion of the potential effects of herbicide use on wild horses and burros. This information is summarized here, with more detailed discussion included for the three active ingredients specifically covered by this PEIS.

Possible direct effects from herbicides include death, damage to vital organs, change in body weight, decreases in healthy offspring, and increased susceptibility to predation. However, these effects are largely dependent on the sensitivity of exposed animals to the herbicide used. Newborn horses and burros would be most susceptible to herbicides, with the March through June foaling season being a critical period. Possible indirect effects include reduction in the amount of forage and the preferred forage type. Additionally, wild horses and burros may move out of HMAs and onto lands that are not legally designated for wild horse and burro management.

Beneficial effects to wild horses and burros could include an increase in the treated area's carrying capacity for wild horses and burros with the removal of non-native, unpalatable species. Additionally, treatments that reduce the risk of future catastrophic wildfire through fuels reduction would also benefit wild horses and burros.

The three herbicides generally have a very low risk to mammals. Therefore, the most likely effects would be associated with habitat modification. Application of herbicides in HMAs would follow guidance in the BLM *Wild Horse and Burros Management Handbook* and associated Herd Management Plans (USDOI BLM 2010b).

Impacts of Aminopyralid

The risk assessment for aminopyralid predicted that none of the possible scenarios of aminopyralid exposure (direct spray, contact with foliage after direct spray, ingestion of food items contaminated by direct spray) would pose a risk to mammals. Therefore, aminopyralid

does not pose a risk to wild horses and burros, even under the unlikely scenario that they would be directly sprayed during an herbicide application. The evaluated scenarios are very conservative because they assume 100 percent absorption of the active ingredient, and that 100 percent of the animal's diet comes from treated vegetation.

Wild horses and burros forage on grasses and forbs, but will also consume some shrubs. Based on a literature review of studies about the diets of wild horses and burros, these animals have a wide variation in diet depending on the habitat and what species are available (Abella 2008). While control of undesirable broadleaf plants by aminopyralid may improve forage for wild horses and burros, it may also reduce the availability of desirable forb species, as well as the diversity of forage species available. Currently, many HMAs are overburdened with wild horse and burro populations (USDOI BLM 2010b). Depending on the target species of the treatment, herbicide treatments with aminopyralid could improve the capacity of HMAs.

Impacts of Fluroxypyr

Based on the information in the ERA, there is no risk to mammals from exposure to fluroxypyr under the modeled dermal and ingestion exposure scenarios. Therefore, this herbicide is safe to apply in habitats used by wild horses in standard BLM herbicide applications, even under direct spray scenarios and assuming that 100 percent of the animal's diet comes from treated vegetation.

Fluroxypyr would be used in tank mixes to help control undesirable rangeland plants. Depending on the target species, use of this herbicide could benefit the quantity and quality of forage in wild horse and burro HMAs.

Impacts of Rimsulfuron

According to the ERA for rimsulfuron, this active ingredient does not pose a risk to mammals under any of the modeled exposure scenarios. These include scenarios involving direct spray, indirect contact with foliage after direct spray, and ingestion of food that has been treated with the active ingredient. Therefore, this herbicide is safe to use in habitats where wild horses and burros occur and forage.

Rimsulfuron targets cheatgrass and other winter annuals. Wild horse and burros are known to feed on invasive annual grasses, although this may be based on availability rather than preference (Abella 2008). Treatments with rimsulfuron may improve forage for wild horse and burros over the long term by increasing the prevalence of more desirable perennial grasses. Additionally, control of fire-dependent winter annuals could decrease the occurrence of catastrophic fires that adversely affect HMAs (USDOI BLM 2010b).

Impacts by Alternative

The following sections discuss the expected effects of each of the four alternatives on wild horses and burros, and compare the effects expected under each alternative. These effects may vary depending on the acreage treated using different application methods and active ingredients, as well as the size of treatment events.

Alternative A – Continue Present Herbicide Use (No Action Alternative)

Under this alternative, the 18 currently approved active ingredients would continue to be available for use in habitats used by wild horses and burros. Potential impacts to wild horses and burros associated with these active ingredients were assessed in the 2007 PEIS (USDOI BLM 2007a:4-138 to 4-143; Tables 4-25 and 4-26). As discussed in that analysis, the currently approved active ingredients have varying levels of risk to wild horses and burros, from no risk to high risk, under certain exposure scenarios for certain herbicides. The mitigation measures in the ROD for the 2007 PEIS (USDOI BLM 2007b: Table 2) were developed to minimize these risks, and would continue to be followed under this alternative.

Herbicide treatments with the currently approved active ingredients, as a component of larger vegetation treatments, would have a long-term positive effect on wild horse and burro communities through improvements in rangeland forage.

The focus of vegetation treatments would continue to be removal and control of invasive vegetation, and improvement of native shrubland and grassland communities. If effective, these treatments would benefit wild horse and burro habitats. Wild horses favor native grasses, including bluebunch wheatgrass, western wheatgrass, Indian ricegrass, and bluegrasses, and riparian/wetland vegetation, including sedges. Wild burros feed on a variety of plants, including grasses, Mormon tea, paloverde, and plantain. Treatments that improve range habitat should benefit these preferred plant species.

Alternative B – Allow for Use of Three New Herbicides in 17 Western States (Preferred Alternative)

Under the Preferred Alternative, the scope and extent of herbicide treatments would be similar to those under the No Action Alternative, but the three new active ingredients would be available for use as part of these treatments. The total area affected by herbicide treatments would be the same as under the No Action Alternative and the other action alternatives (932,000 acres).

The three new active ingredients—aminopyralid, fluroxypyr, and rimsulfuron—are effective at controlling rangeland weeds, but have a low toxicity to mammals. These herbicides could potentially be used to improve habitat in areas used by wild horses and burros, where mitigation measures restrict or limit applications with other chemicals. Based on information provided by the BLM about the likely use of herbicides under this alternative (Table 2-4), glyphosate, imazapic, and picloram would see a substantial reduction in usage as a result of the addition of the three new herbicides. Of these, glyphosate and picloram are associated with low to moderate risks to wild horses and burros under various exposure scenarios, while imazapic does not present a risk. Compared to the No Action Alternative, approximately 7 percent fewer acres would be treated with herbicides that have some level of risk to wild horses and burros under the Preferred Alternative.

Because the same acreage of land would be treated with herbicides under all of the alternatives, there would be few differences as far as long-term benefits to rangelands that support wild horses and burros. However, addition of the new herbicides under this alternative may allow the BLM to more effectively control invasive species and reduce fire risk in wild horse and burro habitats.

Alternative C – No Aerial Application of New Herbicides

This alternative is much like the Preferred Alternative as far as herbicide treatments in wild horse and burro habitats, except that aerial applications of the three new herbicides would be prohibited. For treatments requiring aerial applications, one or more of the currently approved herbicides would be used, similar to the No Action Alternative. Approximately 5 percent fewer acres would be treated with active ingredients that have some level of risk to wild horses and burros, relative to the No Action Alternative.

Long-term benefits to rangelands that support wild horses and burros would be similar to those under the other alternatives, as the acreage of land treated would be the same.

Alternative D – No Use of New Acetolactate Synthase-inhibiting Active Ingredients (No Rimsulfuron)

Under this alternative, rimsulfuron would not be approved for use by the BLM, and would not be used in wild horse and burro habitats. Therefore, glyphosate and imazapic would continue to be used for most treatment programs (including cheatgrass treatments) that would incorporate rimsulfuron under Alternatives B and C. Glyphosate is of low to medium risk to wild horses and burros, but there is no predicted risk associated with use of imazapic. Similar to the Preferred Alternative, approximately 7 percent fewer acres would be treated with herbicides that have some level of risk to wild horses and burros, compared to the No Action Alternative.

Long-term benefits to rangelands that support wild horses and burros would be similar to those under the other alternatives, as the acreage of land treated would be the same.

Mitigation for Herbicide Treatment Impacts

The BLM would continue to implement the SOPs identified earlier in this section, as well as all other SOPs identified in the 2007 PEIS (USDOI BLM 2007a: Table 2-8). Additionally, the mitigation measures for wild horses and burros that were specified in the ROD for the 2007 PEIS (USDOI BLM 2007b:Table 2) would continue to be followed, as applicable.

Given their low toxicological risks, no mitigation measures for wild horses and burros have been proposed specifically for herbicide treatments with aminopyralid, fluroxypyr, or rimsulfuron.

Paleontological and Cultural Resources

Invasive plants are present at paleontological and cultural resource sites on public lands. Invasive plants can impact paleontological and cultural resources by displacing native plants and contributing to soil erosion. Removal of invasive vegetation, when done in such a way that the resources are not adversely affected, can

contribute to the restoration and maintenance of historic and ethnographic cultural landscapes (USDOI National Park Service 2003).

Scoping Comments and Other Issues Evaluated in the Assessment

The BLM received a few comments addressing the potential impact of herbicide treatments on paleontological and cultural resources from tribes and SHPOs. There was a concern about potential impacts to culturally important plants that might be treated with the new active ingredients. One comment stated that to address such impacts, consultation with Indian nations should occur at the local level, once site-specific treatments are known. Additionally, local tribes should be contacted for information about traditional cultural properties and other culturally significant areas that might be impacted. Finally, one comment was concerned with negative impacts to historic buildings, monuments, and cemetery stones from nearby herbicide use.

Standard Operating Procedures for Addressing BLM Actions on Paleontological, Cultural, and Subsistence Resources

The 2007 PEIS documents the BLM's processes for identifying and managing paleontological, cultural, and subsistence resources (USDOI BLM 2007a:4-147 to 4-148). The BLM would continue to follow these processes and protocols for vegetation treatments involving aminopyralid, fluroxypyr, and rimsulfuron. These processes are outlined in a national Programmatic Agreement with the Advisory Council on Historic Preservation and the National Conference of State Historic Preservation Officers, state-specific protocol agreements with SHPOs, resource management plans, and numerous BLM handbooks.

Before proceeding with vegetation treatments, the effects of BLM actions on cultural resources would be addressed through compliance with the NHPA. Effects on paleontological resources would be addressed as outlined in resource management plans developed under the authority of the FLPMA and site-specific NEPA documents developed for vegetation treatments. The BLM's responsibilities under these authorities are addressed as early in the vegetation management project planning process as possible.

The BLM Cultural Resource Management program is responsible for the study, evaluation, protection, management, stabilization, and inventory of paleontological, historical, and archeological resources. The program also ensures close consultation with Native American tribal and Alaska Native group governments. The BLM initiated consultation with these groups to identify their cultural values, religious beliefs, traditional practices, and legal rights that could be affected by BLM actions. Consultation included sending letters to all tribes and groups that could be directly affected by vegetation treatment activities, and requesting information on how the proposed activities could impact Native American and Alaska Native interests, including the use of vegetation and wildlife for subsistence, religious, and ceremonial purposes (see Appendix B).

As discussed in the 2007 PEIS, paleontological, cultural, and subsistence resources within treatment areas would be identified at the local level, and site-specific mitigation measures would be developed during the implementation stage of vegetation treatments, if needed. Mitigation could include steps to avoid or protect cultural resources from treatments. In the case of subsistence resources, treatments may need to be modified or cancelled in certain areas to avoid impacts. Additionally, procedures to protect any cultural resources discovered during the course of vegetation treatments would be developed.

Additional SOPs that would apply to paleontological, cultural and subsistence resources are those pertaining to human health, which would apply to the safety of Native peoples who might visit areas targeted by treatments for subsistence, religious, or other traditional purposes. These procedures include (but are not limited to) posting treated areas with appropriate signs at common public access areas, observing restricted entry intervals specified by the herbicide label, and providing public notification in newspapers or other media when the potential exists for public exposure. Additionally, SOPs pertaining to fish, wildlife, and vegetation would help minimize potential impacts to subsistence resources.

Summary of Herbicide Impacts

The 2007 PEIS (USDOI BLM 2007a:4-148 to 4-149) provides a general discussion of the potential impacts of herbicide use on paleontological, cultural, and subsistence resources. This information is summarized in the sections that follow.

Paleontological Resources

Herbicides may have the potential to effects fossil materials, depending on: 1) fossil type; 2) minerals; 3) degree of fossilization; and 4) whether the fossil is exposed or buried. Herbicides may cause soil acidity to increase, or cause other chemical changes to fossil materials, such as discoloration or deterioration. More likely, damage to fossil materials, if present, would result from the use of wheeled equipment to apply herbicides, particularly vehicles traveling off roads, which could potentially crush fossil materials exposed on the surface. Additionally, herbicide treatments are more likely to affect researchers, students, or other field personnel conducting paleontological research than the paleontological resources themselves.

Cultural Resources

Herbicide treatments could potentially affect buried organic cultural resources, but would be most likely to have an effect on aboveground structures and traditional cultural practices of gathering plant foods or materials important to local tribes or groups. Some chemicals can cause soil acidity to increase, which would result in deterioration of artifacts—even some types of stone from which artifacts are made. Application of chemical treatments can also result in impacts such as altering or obscuring the surfaces of standing wall masonry structures, pictograph or petroglyph panels, and organic materials. One study of the effects of glyphosate and triclopyr on stone and masonry material found that both active ingredients resulted in salt formation and color change. Additionally, glyphosate can lead to a long-term increased rate of deterioration (Oshida 2011). No other active ingredients were included in the study, but it is assumed that other herbicides could adversely affect certain materials as well. While chemicals may affect the surface of exposed artifacts, these materials can generally be removed without damage if treated soon after exposure. Additionally, herbicide treatment SOPs include protocols for identifying cultural resources and developing appropriate measures to mitigate or minimize adverse impacts.

Organic substances used as inactive ingredients in herbicide formulations, such as diesel fuel or kerosene, may contaminate the surface soil and seep into the subsurface portions of a site. These organic substances could interfere with the radiocarbon or Carbon-14 (C-14) dating of a site (USDOI BLM 1991).

Subsistence Resources

Non-target plants affected by herbicide treatments may include species that are important to Native American tribes or Alaska Native groups for traditional subsistence, religious, or other cultural practices. Impacts to these resources would be avoided through local level consultation with tribes and groups to identify areas where plant resources of importance are located. The potential health risks associated with exposure to/consumption of plant materials with herbicide residues are discussed in the Herbicide Impacts on Native American Health section.

Treatments to control noxious weeds and other invasive species could benefit populations of native plant species used as subsistence or for other traditional practices, through restoration of native plant communities.

Fish and wildlife used for subsistence could be adversely affected through temporary displacement from treatment sites or exposure to herbicides. The Fish and Aquatic Invertebrates and Wildlife Resources sections provide more detailed information on potential effects to wildlife from herbicide treatments.

Herbicide Impacts on Native American Health

Risk Assessment Methodology

The potential risks to Native Americans from exposure to herbicides used in BLM programs were evaluated separately from risks to other public receptors (see Human Health and Safety section in this chapter). Native Americans could be exposed to higher levels of herbicides as a result of subsistence and cultural activities such as plant gathering and consumption of fish caught in local streams. Therefore, risk levels determined for Native American receptors reflect unique exposure scenarios as well as typical scenarios for public receptors, but with higher levels of exposure than public receptors.

The risk assessments assume that the Native American receptors (154-pound adult and 33-pound child) are exposed to herbicides via dermal contact with spray, dermal contact with sprayed foliage, ingestion of drinking water from a sprayed pond, ingestion of berries containing spray, dermal contact with water in a sprayed pond, and ingestion of fish from a sprayed pond. These exposure methods are discussed further in the following sections, with additional detail provided in the 2007 PEIS (USDOI BLM 2007a:4-149 to 4-150).

Dermal Contact

For scenarios involving dermal contact with sprayed vegetation, risk assessments assume the following:

- The 50th percentile surface area of the head, lower legs, forearms, and hands are exposed to the herbicide (884 square inches (in^2) for adults and 434 in^2 for children; USEPA 2004).
- Native American receptors contact foliage for 3 hours per day of subsistence activities (Harper et al. 2002).
- Herbicide is transferred from foliage to skin at a rate (171 in^2/hour for adults and 56 in^2/hour for children [USEPA 2012d]).

For scenarios involving swimming in a contaminated pond, the exposure time was assumed to be 2.6 hours per day (Harris and Harper 1997), for 70 days per year. The exposed surface area was assumed to be 2,790 in^2 for an adult swimmer and 1,023 in^2 for a child swimmer (USEPA 2004).

Ingestion

Risk assessments assume that adult Native Americans ingest 1 quart of water per day (Harper et al. 2002) from a sprayed pond, and Native American children consume half the adult rate, or 0.5 quart/day.

The berry ingestion scenario assumes that a Native American adult consumes 0.7 pound (lb)/day (Harper et. al. 2002) and a Native American child consumes 0.15 lb/day (per California Environmental Protection Agency [CalEPA] 1996).

The adult fish ingestion rate was assumed to be 2 lbs/day based on a high fish diet scenario (Harper et al. 2002). The high fish diet consists primarily of fish supplemented by big game; aquatic amphibians, crustaceans, and mollusks; small mammals; and upland game birds. For Native American children, the ingestion rate was scaled by body weight to 0.4 lb/day (per CalEPA 1996).

Since it is assumed that a pond used for swimming is also a source of drinking water, incidental ingestion of contaminated water during swimming was not evaluated separately; it is included in the drinking water scenario.

The methodology for estimating potential risk to human health from exposure to herbicides is discussed in the Human Health and Safety section, under the Human Health Risk Assessment Methodology subsection.

Human Health Risks Associated with the Three New Herbicides

Native American adults face the same risks that public receptors face, as well as additional risks associated with exposure to some herbicides as a result of unique subsistence practices or increased time spent in treated areas. The risks to public receptors are discussed in the Human Health and Safety section. As shown in Table 4-15, there are no risks to public receptors from exposures resulting from routine use (typical or maximum application rate) or accidental scenarios. Additionally, there are no risks to Native American adults or children under any of the modeled exposure scenarios. These results indicate that aminopyralid, fluroxypyr, and rimsulfuron do not pose an unacceptable risk to Native American receptors, even under worst-case accidental exposure scenarios.

See the Vegetation, Fish and Aquatic Invertebrates, and Wildlife Resources sections in this chapter for more information on the potential risks of the three new herbicides to resources used by Native Americans.

Impacts by Alternative

The following is a discussion of how risk from herbicides would vary under each herbicide treatment alternative. Under all alternatives, the maximum acreage treated annually is assumed to be the same, with only the relative amount of each active ingredient used varying among the different alternatives. Under all alternatives, the BLM would use herbicide treatments for resource benefit, which would have beneficial effects on native plants and wildlife used by Native American tribes. Additionally, under all alternatives herbicide usage in Alaska would remain low, estimated at a maximum of 1,000 acres per year. Under all alternatives, the BLM would collaborate with Native American tribes and Alaska Native groups to identify and protect culturally significant plants used for food, basketweaving, fibers, medicine, and ceremonial purposes, and would use minimal impact treatments where culturally significant species are known to occur.

Alternative A – Continue Present Herbicide Use (No Action Alternative)

Under this alternative, only the 18 previously approved herbicides would be available for use. Risks to paleontological and cultural resources, and to human

health would be the same as those discussed under Alternative B of the 2007 PEIS (USDOI BLM 2007a:4-151). There are risks to Native American adults associated with exposure to diquat when it is accidentally spilled or applied at the maximum rate (low risk), and with the consumption of fish contaminated with 2,4-D (high risk) or hexazinone (moderate risk). There are risks to Native American children associated with exposure to diquat when it is applied at the typical rate. There are also risks associated with berry picking in areas sprayed with diquat at the typical rate. Native American adults and children residing near the treatment area face additional risks (i.e., low risk from exposure to diquat when it is applied at the typical or maximum rate, and moderate risk from diquat when accidentally spilled; low risk from exposure to fluridone when it is accidentally spilled).

Alternative B – Allow for Use of Three New Herbicides in 17 Western States (Preferred Alternative)

Under this alternative, aminopyralid, fluroxypyr, and rimsulfuron would be available for use in herbicide treatment programs, and as a result, there would be lower usage of other herbicides, particularly imazapic, glyphosate, and picloram. All of these herbicides have no to low human health risks. Of the herbicides with higher human health risks, use of 2,4-D would be slightly lower than under the No Action Alternative (1 percent fewer acres treated), indicating that risks associated with consumption of fish contaminated by 2,4-D would also be slightly lower. Other herbicides associated with human health risks (diquat, fluridone, and hexazinone) would continue to make up a very small component of the total herbicide usage. Generally, human health risks to Native Americans would be similar to those under the No Action Alternative.

Alternative C – No Aerial Application of New Herbicides

Under this alternative, human health risks to Native American receptors would be similar to those under Alternative B and the No Action Alternative. The new herbicides would not be applied aerially, eliminating certain exposure pathways for Native American receptors. According to the human health risk assessment (HHRA), aerial application scenarios are generally associated with greater overall human health risks than ground-based methods. However, based on information for occupational receptors (see Table 4-14) risks levels for the three new herbicides are similar for aerial and ground applications. Additionally, restriction of aerial applications of the new chemicals would not reduce aerial spraying of herbicides, as different active ingredients would be used where aerial spraying is needed.

Under this alternative, herbicides with higher human health risks would be used at roughly the same levels as under the No Action Alternative, over approximately 1 percent more land area than under the Preferred Alternative. In general human health risks to Native American receptors would be similar to those under the other alternatives.

Alternative D – No Use of New Acetolactate Synthase-inhibiting Herbicides (No Rimsulfuron)

Risks to Native American receptors from exposure to herbicides under Alternative D would be similar to those under the other alternatives. Rimsulfuron would not be used, and as a result the use of glyphosate and imazapic would be higher than under the other action alternatives (similar to the No Action Alternative). All three of these active ingredients pose no to low risk to Native American receptors, so there would be little difference, from a human health standpoint, associated with restricting the use of rimsulfuron. Use of 2,4-D under this alternative would be slightly lower than under the No Action Alternative and Alternative C (1 percent fewer acres), indicating that risks associated with consumption of fish contaminated by 2,4-D would also be slightly lower. In general, human health risks to Native Americans would be similar to those under the other alternatives.

Mitigation for Herbicide Treatment Impacts

The BLM would continue to follow all of the SOPs for herbicide treatments in the 2007 PEIS that apply to paleontological and cultural resources (USDOI BLM 2007a: Table 2-8). Additionally, the BLM would follow the mitigation measures identified in the ROD (USDOI BLM 2007b), which are specific to certain previously approved herbicides and would not apply to the new active ingredients (but would apply if a mixture with one or more of these previously approved herbicides is used).

Given the safety of aminopyralid, fluroxypyr, and rimsulfuron to humans, no additional mitigation measures are recommended for herbicide treatments with these active ingredients.

Visual Resources

Visual resources consist of land, water, vegetation, wildlife, and other natural or manmade features visible on public lands. Vast areas of grassland, shrubland, canyonland, and mountain ranges on public lands provide scenic views to users of public lands. The vegetation of an area, including the presence of native species and noxious weeds, affects its scenic qualities. Herbicide treatments also affect the visual quality of the landscape to varying degrees by killing target vegetation and creating a more open, "browned" landscape. Scenic impacts from herbicide treatments are most likely to be associated with projects that 1) reduce the visual rating of the treatment site over the long term, or 2) result in short- or long-term degradation of high-sensitivity visual resources.

Scoping Comments and Other Issues Evaluated in the Assessment

No scoping comments specific to visual resources were received by the BLM. However, the visual quality of the landscape is seen as a component of public benefit, and management of public lands must take into account visual resources. Lands located in highly visible areas along roads typically provide this benefit to the largest segment of the population.

Standard Operating Procedures

The 2007 PEIS identified several SOPs that would help reduce the impact of herbicide treatments on visual resources:

- Minimize the use of broadcast foliar applications in sensitive watersheds to avoid creating large areas of browned vegetation.
- Consider the surrounding land use before assigning aerial spraying as an application method.
- Avoid aerial spraying near agricultural or densely populated areas, where feasible.
- At areas such as visual overlooks, leave sufficient vegetation in place, where possible, to screen views of vegetation treatments.
- Use SOPs that minimize off-site drift and mobility of herbicides (e.g., do not treat when winds exceed 10 mph; minimize treatment in areas where herbicide runoff is likely; and establish appropriate buffer widths between treatment areas and residences), to contain the visual changes to the intended treatment area.
- If the area is a Class I or II visual resource, ensure that the change to the characteristic landscape is low and does not attract attention (Class I), or if seen, does not attract the attention of the casual viewer (Class II).
- Lessen visual impacts by 1) designing projects to blend in with topographic forms; 2) leaving some low-growing trees or planting some low-growing tree seedlings adjacent to the treatment area to screen short-term effects; and 3) revegetating the site following treatment.
- When restoring treated areas, design activities to repeat the form, line, color, and texture of the natural landscape character to meet established VRM objectives.

These SOPs are designed to minimize visual impacts associated with killing invasive plants and removing vegetation. Additional guidance is provided in BLM Manual Handbook H-8431-1, *Visual Resource Contrast Rating* (USDOI BLM 1986b). No additional mitigation for herbicide treatments were proposed in the 2007 PEIS or specified in the 2007 ROD.

BLM Assessment of Visual Resource Values

As discussed in BLM Handbook H-8410-1, *Visual Resource Inventory* (USDOI BLM 1986a), potential visual impacts from proposed activities must be assessed to determine whether the potential impacts will allow the management objective for the affected area to be met. A visual contrast rating is used, in which the project features are compared with the major features in the existing landscape, using basic design elements of form, line, color, and texture. This process is described in BLM Handbook H-8431-1, *Visual Contrast Rating* (USDOI BLM 1986b). Activities or modifications in a landscape that repeat the basic design elements are thought to be in harmony with their surroundings. Modifications that do not harmonize are said to be in contrast with their surroundings.

Visual resource assessments would be conducted at the project level to determine the potential impacts to visual

resources associated with defined vegetation treatment projects.

Summary of Herbicide Impacts

As the overall vegetation treatment program is programmatic in scope, no visual contrast rating was conducted for the 2007 PEIS. It is expected that this sort of analysis would occur at the local level for site-specific herbicide treatment programs. Instead, the 2007 PEIS gave a general overview of how herbicide treatments affect the visual quality of treated areas (USDOI BLM 2007a:4-154). As the new active ingredients affect vegetation in the same general way as some of the currently approved active ingredients, the general impact analysis for herbicide use in the 2007 PEIS would continue to apply even with the addition of aminopyralid, fluroxypyr, and rimsulfuron to the list of approved active ingredients.

In general, herbicide treatments have short-term negative effects and long-term positive effects on visual resources. Herbicide treatments create openings and patches of discolored vegetation that may contrast markedly from surrounding areas of green vegetation. However, these impacts would begin to disappear within one to two growing seasons in most landscapes. Over the long term, herbicide treatments would likely improve visual resources on public lands by removing infestations of invasive plants and rehabilitating degraded ecosystems. Native-dominated communities tend to be more visually appealing than plant communities that have been overtaken by noxious weeds or other undesired species. Additionally, control of species that serve as fuels for wildland fire would help reduce the size and intensity of future wildfires. A reduces risk of fire would benefit visual resources, as wildland fires substantially degrade the visual quality of natural areas.

Impacts by Alternative

Alternative A – Continue Present Herbicide Use (No Action Alternative)

Under the No Action Alternative, the BLM would continue to implement vegetation treatment projects using the herbicides currently approved under the ROD for the 2007 PEIS. As discussed in the 2007 PEIS, short-term adverse impacts to visual resources associated with herbicide use would continue to occur. The most dramatic effects would be seen in states with the most acres treated, such as New Mexico, Idaho, and Wyoming, and in project areas where large acreages are treated.

Herbicide treatments in drier states, such as New Mexico, Nevada, and Wyoming, could have a reduced visual impact relative to those in more lush states because visual color contrast between natural and “browned” treated areas would be less dramatic.

Landscapes containing a large component of invasive species often contrast with surrounding natural landscapes and have a negative visual impact. For example, cheatgrass often turns brown during summer, while native species usually remain green long into summer or fall. Over the long-term ongoing vegetation treatments under this alternative would have a positive impact on visual resources, as invasive plants and unwanted vegetation would be removed, and visually preferable native vegetation and ecosystems would become reestablished.

Alternative B – Allow for Use of Three New Herbicides in 17 Western States (Preferred Alternative)

Under this alternative, impacts to visual resources would be much the same as those under the Preferred Alternative. The same acreage of public lands would be impacted by vegetation treatments, and the geographic locations and size of treatments would be similar to those discussed under the No Action Alternative. It is possible that the availability of the three new active ingredients would result in some changes to treatments, but it is expected that these changes would be minor.

If vegetation treatments prove to be more effective as a result of being able to use aminopyralid, fluroxypyr, and rimsulfuron, there could be greater short-term visual impacts associated with removal of target vegetation. However, associated long-term benefits of recovery of native plant communities could also be greater.

Alternative C – No Aerial Application of New Herbicides

While aminopyralid, fluroxypyr, and rimsulfuron would not be applied aerially under Alternative C, the currently approved active ingredients would continue to be available for aerial applications. Therefore, the overall extent of aerial treatments with herbicides should not differ substantially from that under Alternatives A and B. The total acreage of public lands affected by herbicide treatments would be the same as under the other alternatives, and the geographic

locations and size of treatments would be similar to those discussed under the other alternatives. Short-term impacts and long-term beneficial effects to visual resources would be similar to those under the other alternatives.

Alternative D – No Use of New Acetolactate Synthase-inhibiting Active Ingredients (No Rimsulfuron)

While rimsulfuron would not be available for use under this alternative, the 18 currently approved active ingredients would be available for use, in addition to aminopyralid and fluroxypyr. The total acreage of public lands affected by herbicide treatments would be the same as under the other alternatives, and the geographic locations and size of treatments would be similar. Therefore, short-term impacts and long-term beneficial effects to visual resources would be similar to those under the other alternatives

Mitigation for Herbicide Treatment Impacts

The BLM's SOPs for minimizing impacts to visual resources, listed earlier in this section would continue to be implemented when conducting vegetation treatments. These SOPs would help reduce short-term impacts associated with all herbicides, including aminopyralid, fluroxypyr, and rimsulfuron.

No mitigation measures are proposed for visual resources.

Wilderness and Other Special Areas

Because of their special status, wilderness and other special areas have strict guidelines for vegetation treatments. These guidelines prohibit activities that degrade the quality, character, and integrity of these protected lands. Manipulation of vegetation through use of herbicides and other methods is generally not permitted, although there are exceptions in the case of emergencies (e.g., wildfire threatens non-federal lands), actions taken to recover a federally listed threatened or endangered species, control of non-native species, and restoration actions where natural processes alone cannot recover the area from past human intervention (USDOI BLM 2012e).

In Wilderness Study Areas, natural processes are relied on to maintain native vegetation and natural disturbance regimes. However, vegetation treatments, including herbicide applications, are allowed if they meet the non-impairment standard (i.e., temporary and not creating surface disturbance), or if they are conducted in emergency circumstances, to protect or enhance wilderness characteristics, are grandfathered uses or valid existing rights, or are done to recover a federally listed or candidate species (USDOI BLM 2012f).

There are no set restrictions on vegetation treatments in other types of special areas. However, the unique characteristics of these areas would be considered when preparing management plans for treatment activities.

Herbicides may be applied in wilderness and other special areas under circumstances described in local Resource Management Plans or relevant NEPA documents. Herbicide treatments could affect these areas by altering the existing plant species composition and structure, and altering the visual qualities of treated areas.

Scoping Comments and Other Issues Addressed in the Assessment

None of the scoping comments received by the BLM were specific to wilderness or other special areas.

Standard Operating Procedures

The 2007 PEIS identified several SOPs to reduce the risk of spreading noxious weeds, prevent the establishment of new invaders, and promote public awareness to be followed in wilderness areas and other special areas:

- Encourage backcountry pack and saddle stock users to feed their livestock only weed-free feed for several days before entering a wilderness area.
- Encourage stock users to tie and/or hold stock in such a way as to minimize soil disturbance and loss of native vegetation.
- Revegetate disturbed sites with native vegetation if there is no reasonable expectation of natural regeneration.
- Provide educational materials at trailheads and other wilderness entry points to educate the public on the need to prevent the spread of invasive plants.

- Use the "minimum tool" to treat noxious and invasive vegetation, relying primarily on use of ground-based tools, including backpack pumps, hand sprayers, and pumps mounted on pack and saddle stock.
- Use chemicals only when they are the minimum method necessary to control invasive plants that are spreading within the wilderness or threaten lands outside the wilderness.
- Give preference to those herbicides that have the least impact on non-target species and on the wilderness environment.
- Implement herbicide treatments during periods of low human use, where feasible.
- Address wilderness and other special areas in management plans.
- Maintain adequate buffers for Wild and Scenic Rivers (¼ mile on either side of river, ½ mile in Alaska).

These SOPs would continue to apply to herbicide treatments involving the three new herbicides. No mitigation measures specific to wilderness or other special areas were identified in the 2007 PEIS. However, all pertinent mitigation in the Vegetation, Fish and Other Aquatic Resources, Wildlife Resources, Recreation, and Human Health and Safety sections would potentially be applicable to herbicide treatments in these areas.

Summary of Herbicide Impacts

The 2007 PEIS provides a general overview of the effects of herbicide treatments on wilderness and other special areas (USDOI BLM 2007a:4-156 to 4-157). The discussion addresses herbicide treatments in general, and does not include a discussion of impacts specific to any of the active ingredients currently approved for use.

In general, herbicide treatments in wilderness and other special areas would have short-term negative effects and long-term positive effects on special status area values. Herbicide treatments could result in short-term closures of special areas, and in disturbance and removal of vegetation from treated areas. In the case of wilderness areas and WSAs, only treatments that improve the natural condition of these areas would be allowed. Furthermore, use of motorized equipment to apply herbicides would need to be authorized based on further site-specific NEPA and minimum requirements analysis, in accordance with BLM policy.

Long-term effects of treatments in special areas would be beneficial, as noxious weed infestations and risk of future catastrophic wildfires would be reduced in these areas. The reduction of hazardous fuels and noxious weeds on lands adjacent or near to special areas would provide long-term benefits by reducing the likelihood that noxious weeds would spread onto these unique areas, or that a catastrophic wildfire would burn through them, thus degrading their unique qualities. Herbicide treatments in wilderness areas and WSAs, if successful, would potentially improve the naturalness component of wilderness character.

Impacts by Alternative

Generally, there would be few differences between the alternatives as far as potential effects to wilderness and other special areas, as the extent of treatments in these areas would likely be the same under all the alternatives.

Alternative A – Continue Present Herbicide Use (No Action Alternative)

Under the No Action Alternative, the BLM would continue its herbicide treatments in wilderness and other special areas with the 18 currently approved herbicides. For example, herbicide treatments would continue to be used to control incipient populations of noxious weeds and other invasive species in order to prevent the expansion of these populations in wilderness and other special areas. Additionally, the risk of wildland fire could be reduced in these areas. Therefore, treatments would benefit the targeted areas and help protect their unique qualities.

Special areas that receive herbicide treatments would continue to be affected by disturbance associated with access to the treatment site (particularly for repeat treatments), and by a temporary reduction in the "naturalness" of the treated area with the loss of target vegetation. Additionally, users of these areas might be impacted by short-term closures following herbicide applications (see the Recreation section for more information). In most cases, the benefits of eradicating noxious weeds and reducing the risk of wildland fire would outweigh the potential short-term effects of chemical treatments.

Alternative B – Allow for Use of Three New Herbicides in 17 Western States (Preferred Alternative)

Under the Preferred Alternative, effects to wilderness and other special areas would be similar to those under the No Action Alternative. Herbicide treatments in these areas would likely involve the three new active ingredients, as warranted, and could be more effective at controlling target species as a result. However, given that the overall method and extent of treating wilderness and species areas would be more or less the same as under the No Action Alternative, there would be only minor differences as far as effects to these areas.

The three new active ingredients are all of low risk to human health (see the Human Health and Safety section for additional information), with no risk to public receptors under routine or accidental exposure pathways. However, the active ingredients that are likely to decrease in usage as a result of adding the three new active ingredients also have low to no risk to human health. Therefore, there would be very little difference between the Preferred Alternative and the No Action Alternative as far as potential impacts to the health of users of wilderness and other special areas from herbicide treatments.

Alternative C – No Aerial Application of New Herbicides

While the three new herbicides would not be applied aerially under Alternative C, the total extent of aerial treatments using herbicides would likely be the same as under Alternative B, as other herbicides could still be applied via this method. Overall, it is not expected that aerial applications would be used to target wilderness and other special areas, as treatments would generally not be this widespread. Impacts under this alternative would be similar to those under the other alternatives, with short-term adverse effects associated with treatments and long-term benefits associated with the removal of noxious weeds. Potential impacts to the health of users of wilderness and other special areas from herbicide treatments would also be similar to those under the other alternatives.

Alternative D – No Use of New Acetolactate Synthase-inhibiting Active Ingredients (No Rimsulfuron)

Rimsulfuron would not be used to treat vegetation under Alternative D, but treatments in wilderness and other special areas could be completed with any of the currently approved herbicides, aminopyralid, or fluroxypyr. The extent of treatments in wilderness and other special areas and the species targeted would be the same as under the other alternatives. Effects to these areas would be similar to those under the other alternatives, with short-term adverse effects associated with treatments and long-term benefits associated with the removal of noxious weeds. Potential impacts to the health of users of wilderness and other special areas from herbicide treatments would also be similar to those under the other alternatives.

Mitigation for Herbicide Treatment Impacts

The BLM's SOPs for minimizing impacts to wilderness and other special areas, listed earlier in this section, would continue to be implemented when conducting vegetation treatments. These SOPs would help reduce short-term impacts associated with all herbicides, including aminopyralid, fluroxypyr, and rimsulfuron.

Mitigation measures that may apply to wilderness and special area resources are associated with human and ecological health and recreation. Please refer to the Vegetation, Fish and Other Aquatic Resources, Wildlife Resources, Recreation, and Human Health and Safety sections of this chapter. No mitigation measures are proposed specifically for wilderness or other special areas.

Recreation

In areas that support high recreation use, the goals of vegetation treatments include maintaining the appearance of the area and protecting visitors from the adverse effects of contact with noxious weeds and other invasive/unwanted species. In these areas, herbicide use is generally limited to spot treatments. However, larger herbicide treatments would be more likely with increasing distance away from high-use visitor areas. Thus, hikers, hunters, campers, horsemen, livestock owners, and users of plant resources for cultural, social, and economic purposes would be at the greatest risk of coming into contact with herbicide treatment areas.

Scoping Comments and Other Issues Evaluated in the Assessment

No scoping comments specific to recreation were received by the BLM.

Standard Operating Procedures

The 2007 PEIS presented several SOPs that the BLM follows to help minimize the negative impacts of herbicide treatments on recreation:

- Schedule treatments to avoid peak recreational use times, while taking into account the optimum management period for the targeted species.
- Notify the public of treatment methods, hazards, times, and nearby alternative recreation areas.
- Adhere to entry restrictions identified on the herbicide label for public and worker access.
- Post signs noting exclusion areas and the duration of exclusion, if necessary.
- Use herbicides during periods of low human use, where feasible.

These SOPs would continue to apply to herbicide treatments involving the three new active ingredients. Additionally, SOPs identified in the Human Health and Safety, Fish and Aquatic Resources, and Wildlife Resources sections would further reduce risks to recreationists and the resources they use.

Summary of Herbicide Impacts

The 2007 PEIS provides a general discussion of the potential effects of herbicide treatments on recreation (USDOI BLM 2007a:4-160 to 4-161). This general effects analysis would also apply to treatments involving the three new herbicides, and is briefly summarized here.

Herbicide treatments would have short-term negative impacts and long-term positive impacts on recreation. During treatments, there would be some scenic degradation, as well as distractions to users (e.g., noise from machinery). In addition, there would be some human health risks to recreationists associated with exposure to herbicides. These risks are discussed in more detail in the Human Health and Safety section. The three new herbicides generally pose very little risk to human health for public receptors, even under scenarios involving an accidental spraying by an herbicide, entering a treated area soon after herbicide application, or accidentally coming into contact with herbicides that have drifted downwind. Finally, some areas would be off-limits to recreation activities as a result of treatments, generally for a few hours or days, but potentially for at least one full growing season or longer depending on the treatment. In most cases, recreationists would be able to find alternative sites offering the same amenities, but a lessened experience could result if concentrated use occurred in these alternative sites.

Over the long term, herbicide treatments would have a positive effect on recreation through the removal of undesirable vegetation on treated lands. Herbicide treatments would likely return public lands to a more “natural” or desirable condition, which hikers and nature enthusiasts would likely value over degraded lands. In addition, the increased aesthetic value of treated sites would benefit most recreational users. Treatments to reduce fuels would reduce the risk of wildfire in or near recreation areas. Additionally, treatment of sites to restore native vegetation would enhance fish and wildlife habitat, to the benefit of hunters, birdwatchers, and other users of these resources.

Impacts by Alternative

Alternative A – Continue Present Herbicide Use (No Action Alternative)

Under the No Action Alternative, the BLM would continue its vegetation treatments with the 18 active ingredients that are currently approved for use. This alternative corresponds to the Preferred Alternative in the 2007 PEIS (USDOI BLM 2007a:4-162). The maximum acres of public lands treated with herbicides would remain at 932,000 annually, and the states with the most treatments would continue to include Idaho, Nevada, Wyoming, and New Mexico. While these states were estimated to account for 76 percent of treatment acres under this alternative, they accounted for only 18 percent of visitor days during 2012 (USDOI BLM 2012b). Therefore, it is likely that an extensive portion of the land affected by herbicide treatments would occur in areas with a relatively low density of recreational visitors.

Under this alternative, short-term impacts and long-term benefits would occur on up to 932,000 acres of lands annually. Depending on the success of treatments, it is expected that degradation of public lands from wildland fires and infestations of invasive plants would decrease,

and recreational users would be able to have improved outdoor experiences.

Alternative B – Allow for Use of Three New Herbicides in 17 Western States (Preferred Alternative)

This alternative would allow aminopyralid, fluroxypyr, and rimsulfuron to be used in the BLM's herbicide treatment projects, allowing increased flexibility for meeting treatment objectives. The land area treated and the states with the largest amount of treatment acres would be the same as under the No Action Alternative. Therefore, the nature, extent, and intensity of impacts to recreation would be similar to those under the No Action Alternative.

The long-term benefits associated with this alternative would also be similar to those under the No Action Alternative, given that the program goals and target species would not change. Allowing the three new herbicides could result in more effective treatments, which would have a slightly higher degree of benefit to recreation than under the No Action Alternative.

Alternative C – No Aerial Application of the New Herbicides

It is unlikely that aerial spraying would occur in high public use recreational areas under any of the alternatives. Although the new herbicides would not be applied aerially under Alternative C, aerial applications of currently approved herbicides would still occur in dispersed use areas at the same level as under the other alternatives. The land area treated and the states with the most treatment acres would be the same as under the other alternatives. Therefore the nature, extent, and intensity of impacts to recreation also would be similar to those under the other alternatives.

The long-term benefits associated with Alternative C would be similar to those under the other alternatives, with a reduction in degradation of public lands used for recreation by invasive plants and wildland fire.

Alternative D – No Use of New Acetolactate Synthase-inhibiting Active Ingredients (No Rimsulfuron)

While use of rimsulfuron would not be allowed under Alternative D, herbicide treatments would be completed with the 18 currently approved herbicides, as well as aminopyralid and fluroxypyr. The land area treated and the states with the largest treatment acreage would be the same as under the No Action Alternative and all of the action alternatives. Therefore, impacts to recreational sites and recreational users would be similar to those under the other alternatives.

The long-term benefits to recreation under this alternative would also be similar to those under the other alternatives. Program goals and target species would not change, so the only differences would be in terms of the effectiveness of treatments. Rimsulfuron would not be available to treat cheatgrass, but other herbicides such as imazapic and glyphosate would. Depending on the location and type of treatment, these currently approved herbicides may be less effective than rimsulfuron at controlling annual grasses in certain scenarios.

Mitigation for Herbicide Treatment Impacts

The BLM's SOPs for minimizing impacts to recreation, listed earlier in this section, would continue to be implemented when conducting vegetation treatments. These SOPs would help reduce short-term impacts associated with all herbicides, including aminopyralid, fluroxypyr, and rimsulfuron.

Mitigation measures that may apply to recreational resources are associated with human and ecological health. Please refer to the Vegetation, Fish and Other Aquatic Resources, Wildlife Resources, and Human Health and Safety sections of this chapter. No mitigation measures that pertain specifically to recreation are proposed.

Social and Economic Values

Introduction

Herbicide treatments have the potential to affect people, communities, and economies in each of the 17 western states that could receive treatments. Public lands support ranching (grazing leases), mining, active and passive recreation opportunities, and a myriad of other activities that westerners rely on. In addition to these resource uses, public lands provide social values that may not be readily quantifiable. The large expanses of federal lands are a significant contributor to the open spaces that define the "sense of place" in many parts of the West. Therefore, actions that affect federal lands, such as the application of herbicides, have the potential to affect the economic and social environment of the region.

The type of social and economic analysis presented in this PEIS will be similar to what was provided in the 2007 PEIS. Given its programmatic nature, this PEIS will address only general effects and expected trends, with more detailed, site-specific analyses conducted at the local level during the development of herbicide treatment projects. Additionally, since the bulk of the analysis in the 2007 PEIS was general to herbicide treatments, and not specific to the herbicides being considered, much of the analysis is the same for treatments involving the three new herbicides. This information will be referenced and summarized, as appropriate, with additional discussion that involves any new information that is available.

Scoping Comments and Other Issues Evaluated in the Assessment

Several scoping comments were concerned with the potential economic impacts to home and commercial gardeners and composters associated with use of the new herbicides. Aminopyralid, in particular, was identified as a concern based on reports and personal observations about the persistence of this herbicide in manure, compost materials, and hay, and subsequent damage to crops where the contaminated materials were used. Additionally, a few comments cited potential damage to crops from movement of herbicides on windblown dust and off-site drift.

Other comments addressed the cost of the new herbicides relative to herbicides that are currently being used, and the cost of herbicide treatments in general, relative to other treatment methods. There was general support for aminopyralid, fluroxypyr, and rimsulfuron in terms of their effectiveness and the potential to reduce the cost of herbicide treatments.

As discussed in the 2007 PEIS (USDOI BLM 2007a:4-164), the interests of all stakeholders must be considered when planning treatment programs, and the alternative selected for implementation must balance out the interests of national and local stakeholders.

Standard Operating Procedures

The 2007 PEIS (USDOI BLM 2007a:4-164 to 4-165) lists SOPs that have been designed by the BLM to reduce potential adverse impacts to social and economic conditions from the application of herbicides:

- Consider surrounding land use before selecting aerial spraying as a treatment method, and avoid aerial spraying near agricultural or densely-populated areas.
- Post treated areas and specify reentry or rest times, if appropriate.
- Notify adjacent landowners prior to treatment.
- Notify grazing permittees of livestock feeding restrictions in treated areas if necessary, as per label instructions.
- Notify the public of the project to improve coordination and avoid potential conflicts and safety concerns during implementation of the treatment.
- Control public access until potential treatment hazards no longer exist, per label instructions.
- Observe restricted entry intervals specified by the herbicide label.
- Notify local emergency personnel of proposed treatments.
- Avoid aerial spraying during periods of adverse weather conditions (imminent snow or rain, fog, or air turbulence).
- During helicopter applications, apply herbicides at an airspeed of 40 to 50 miles per hour (mph), and at an elevation of about 30 to 45 feet above ground.
- Comply with herbicide-free buffer zones to ensure that drift will not affect crops or nearby residents/landowners.
- Use spot applications or low-boom broadcast applications where possible to limit the probability of contaminating non-target food and water sources, especially vegetation over areas larger than the treatment area.
- Consult with Native American tribes and Alaska Native groups to locate any areas of vegetation that are of significance to the tribe and that might be affected by herbicide treatments.
- Work with Native American tribes and Alaska Native groups to minimize impacts to vegetation of cultural significance to the tribes.

- To the degree possible within the law, hire local contractors and workers to assist with herbicide application projects.

- To the degree possible within the law, purchase materials and supplies, including chemicals, for herbicide treatment projects through local suppliers.

- To minimize fears based on lack of information, provide the public with educational information on the need for vegetation treatments and the use of herbicides in an IPM program for projects proposing local use of herbicides.

These SOPs would continue to apply to herbicide treatments involving the new chemicals. No additional mitigation for social and economic values were identified in the 2007 PEIS.

Impact Assessment Assumptions

This impact assessment generally makes the same assumptions that were discussed in the 2007 PEIS (USDOI BLM 2007a:4-165). Site-specific information on likely use of the three new herbicides is unavailable, and no information on specific application parameters will be included. Other assumptions include the following:

- Communities that are particularly dependent on a single industry (e.g., ranching and recreation-dependent communities) are more susceptible to the effects of herbicide use than other communities.

- The proposed use of the new herbicides would only apply to public lands.

- None of the alternatives would significantly affect ongoing, long-term trends such as the increasing demand for outdoor recreation or growth in urban, suburban and rural populations.

- Treatments involving the new herbicides would meet the project objective of improving the effectiveness of the BLM's vegetation treatment programs. In turn, the cost of wildland fire suppression and the loss of life and property would be reduced.

Summary of Herbicide Impacts

The 2007 PEIS provides a general discussion of the effects of herbicide treatments on social and economic values (USDOI BLM 2007a:4-165 to 4-166). These effects would continue to apply to herbicide treatments involving the three new herbicides. They generally include social effects deriving from perceptions of health and safety risks for different chemicals; the success or failure of treatments using different chemicals; economic effects associated with changes in range productivity, wildfire risk, and access or attractiveness for recreation activities, and associated changes in employment and income; and direct and indirect economic effects tied to the cost of applying the herbicides.

Impacts of Aminopyralid

The BLM estimates that the cost per acre to apply aminopyralid, based on the typical application rate of this active ingredient, would be $6.73 per acre. Therefore, aminopyralid would be relatively inexpensive to apply, based on a review of the range of costs for the currently approved active ingredients provided in Table 3-21 ($1 to $115 per acre).

Use of aminopyralid is a concern from an economic standpoint because of its persistence in plant materials. If manure or compost originating from plant materials that were previously treated with aminopyralid is used on personal or commercial crops, loss of broadleaf crops may occur. Incidents of crop and garden damage as a result of using organic matter with aminopyralid residues have been reported (Washington State University Extension 2011). In 2010, several farmers and gardeners in Washington State lost most of their vegetable crops as a result of herbicide residues from composted dairy manure (Oregon State University 2011). Therefore, this active ingredient can be associated with economic impacts to private landowners if not used in accordance with the label directions. The BLM would follow all label restrictions to prevent impacts to crops and gardens associated with use of this herbicide, including restrictions on grazing where applicable. The BLM would not export manure, plant residues, or other materials that may be treated with aminopyralid for use as soil amendments.

Because aminopyralid is an active ingredient that targets broadleaf plants, it could be associated with damage to off-site crops as a result of herbicide drift. As discussed in the vegetation section, buffers would be required to

prevent impacts to non-target plants, which would include commercial crops and other broadleaf plants. Therefore, the buffers specified in Table 4-8 would be applicable to treatments with aminopyralid that are near private lands.

Impacts of Fluroxypyr

According to estimates from the BLM, the cost per acre to apply fluroxypyr is $16.53, based on the typical application rate. It is relatively expensive, compared to the costs of the currently approved active ingredients (Table 3-21), but would only be used in small quantities.

Like aminopyralid, fluroxypyr targets broadleaf plants, and therefore may adversely affect nearby croplands and other private lands as a result of herbicide drift. As discussed in the Vegetation section, buffers would be required to prevent impacts to non-target plants, which would include commercial crops and other broadleaf plants. Therefore, the buffers specified in Table 4-8 would be applicable to treatments with aminopyralid in the vicinity of private lands.

Impacts of Rimsulfuron

The BLM estimates that the cost per acre to apply rimsulfuron, based on the typical application rate of this active ingredient, would be $2.81 per acre. It is relatively inexpensive, compared to the costs associated with the currently approved active ingredients (Table 3-21). Rimsulfuron is substantially cheaper than imazapic, which costs $10 to $15 per acre, depending on the mode of application.

Rimsulfuron has activity on annual plants, and could harm certain crops and other non-target plants grown commercially. Buffers would be required to prevent impacts to non-target plants on private lands, as discussed in the Vegetation section and Table 4-8, to reduce the potential for adverse economic effects to nearby landowners.

Impacts by Alternative

Impacts Common to All Alternatives

The 2007 PEIS (USDOI BLM 2007a:4-171) includes a substantial discussion on the impacts of herbicide treatments on population and demography, environmental justice, protection of children, employment and income, perceptions and values, invasive species control cost savings, wildland fire cost savings, economic activity and public revenues generated from BLM lands, expenditures by the BLM, and effects on private property. Because the three new active ingredients would be incorporated into larger herbicide treatment programs, with the same maximum acreage assumed, these general impacts associated with herbicide treatments would continue to occur. Differences would be limited to which active ingredients would be used. These differences are captured in the earlier discussion specific to each of the three new active ingredients, as well as in the discussions for each of the alternatives.

Under all alternatives, herbicide treatments could occur on public lands near minority or low-income populations. As discussed in the 2007 PEIS (USDOI BLM 2007a:4-167), it is not possible to determine whether these populations would be disproportionately affected at the broad scale of analysis in this PEIS. Specific evaluation of environmental justice impacts would be conducted in concert with environmental analyses for site-specific treatment project proposals. Additionally, ongoing consultation and close communication with Indian tribes about the locations and timing of future herbicide treatments would continue to address potential impacts to Native American populations.

Impacts of Individual Alternatives

Alternative A – Continue Present Herbicide Use (No Action Alternative)

This alternative corresponds to the Preferred Alternative under the 2007 PEIS (USDOI BLM 2007a:4-172 to 4-173). Herbicide treatments would occur on 932,000 acres annually in 17 western states, and would include only the 18 currently approved herbicides. These treatment levels would be much the same as at present, so there would likely be little change to existing patterns and trends in population or demographic conditions in the western U.S. Additionally, no changes in employment associated with herbicide treatment would occur.

Herbicide treatments would continue to generate some employment in geographic areas affected by the treatments, but the jobs would generally be short-term, temporary positions or contracted work, which do not encourage in-migration of workers and their families.

Herbicide treatments would take place on public lands, away from areas where children are known to congregate, such as schools and playground. While

children may visit public lands or live in the vicinity, they are unlikely to make up a disproportionate percentage of nearby populations or visitors to public lands. Buffers between residences and treatment areas and advance communication of treatments and site closures would minimize risks to children. Therefore, disproportionate impacts to children should not occur.

The 2007 PEIS estimated the costs to treat vegetation under the Preferred Alternative (USDOI BLM 2007a:4-172), which corresponds to the No Action Alternative for this PEIS. This estimate is based on a maximum total annual treatment area of 932,000 acres. While the BLM's current levels of treatment are much lower, this PEIS assumes that the assumptions for treatment acres in the 2007 PEIS will carry forward. Assuming this maximum acreage and inflation costs of approximately 3 percent per year since 2007, the estimated costs to treat vegetation using herbicides would be approximately $110 million per year.

Herbicide treatments that reduce fire risk would continue to be associated with cost savings associated with reduced need for wildland fire suppression and reduced loss of property. These savings cannot be quantified. Herbicide treatments would also help reduce the spread of noxious weeds, which would provide some level of economic benefit by reducing the future costs of vegetation management.

Commercial activities that occur on public lands, such as timber sales, grazing, and recreation would continue to be impacted a minor amount by herbicide treatments. Additionally, there would continue to be a risk for herbicide treatments to impact private property, which could result in damage to crops or other non-target plants of commercial value.

Alternative B – Allow for Use of Three New Herbicides in 17 Western States (Preferred Alternative)

Under the Preferred Alternative, the total acres treated with herbicides each year would be the same as under the No Action Alternative. However, the breakdown in use of the various active ingredients would change with the introduction of aminopyralid, fluroxypyr, and rimsulfuron. Under this alternative, there would be a substantial reduction (by 21 percent) in the use of glyphosate, imazapic, and picloram, and the new active ingredients aminopyralid and rimsulfuron would make up 26 percent of herbicide use, based on acres treated. Fluroxypyr, though relatively expensive, would only constitute 1 percent of all acres treated. Glyphosate, imazapic, and picloram are more expensive than aminopyralid and rimsulfuron. Therefore, the estimated costs to treat vegetation with herbicides (based on the cost and projected future use of each active ingredient) would be lower under this alternative than under the No Action Alternative. The estimated reduction in herbicide costs is 1 to 2 percent per year.

In most other regards, the potential social and economic impacts associated with herbicide treatments would be similar to those under the No Action Alternative. While there could be minor differences in the effectiveness of certain herbicide treatments with the availability of the new active ingredients, these differences would not reflect measurable changes in socioeconomic impacts.

No changes in populations and demography, or employment, would occur. The potential for disproportionate adverse effects to minority populations and children would continue to be low. The level of economic benefit associated with fuels reduction and control of noxious weeds would be similar to that under the No Action Alternative, as would the level of risk to commercial activities on public lands and adjacent private properties.

This alternative would allow the use of aminopyralid, which is of concern from an economic standpoint for its potential to damage crops and gardens if used inappropriately. However, the currently approved herbicides clopyralid and picloram are also pyridine carboxylic acids with a similar residual activity in manure and plant materials. While total use of this class of herbicides would increase by approximately 7 percent relative to the No Action Alternative, in all cases, risks could be avoided by adhering to the restrictions on the herbicide label.

Alternative C – No Aerial Application of New Herbicides

Under Alternative C, the total acres treated with herbicides each year would be the same as under the other alternatives, and the list of active ingredients used would be the same as under the Preferred Alternative. However, the relative amount used would vary somewhat because the three new active ingredients would only be applied using ground methods, and could not be utilized in aerial-based herbicide treatments. Under this alternative, there would be a smaller reduction in use of more expensive active ingredients, as less of the new active ingredients would be used than under the Preferred Alternative. Costs to treat vegetation using herbicides (based on the cost and projected future

use of each active ingredient) would likely decrease, but by a lesser amount, estimated at less than 1 percent per year.

Other social and economic impacts associated with herbicide treatments would be similar to those under the other alternatives. No changes in populations and demography, or employment, would occur. The potential for disproportionate adverse effects to minority populations and children would continue to be low. The level of economic benefit associated with fuels reduction and control of noxious weeds would be similar to that under the other alternatives, as would the level of risk to commercial activities on public lands and adjacent private properties.

This alternative would entail slightly less use of aminopyralid than under the Preferred Alternative, but total use of the three pyridine carboxylic acids of particular concern would be just 1 percent less than under the Preferred Alternative. In all cases, risks could be avoided by adhering to the restrictions on the herbicide label.

Alternative D – No Use of New Acetolactate Synthase-inhibiting Active Ingredients (No Rimsulfuron)

Under Alternative D, the total acreage treated with herbicides each year would be the same as under the other alternatives. The list of active ingredients would be different than under the other alternatives, however, as aminopyralid and fluroxypyr would be approved for use and rimsulfuron would not. Under this alternative, there would be very little reduction in the use of glyphosate and imazapic, but a substantial reduction in the use of picloram. Costs to treat vegetation using herbicides would not decrease by a substantial amount, relative to the No Action Alternative. The herbicide cost reduction is estimated at a fraction of a percent per year, much lower than under Alternatives B and C.

Other social and economic impacts associated with herbicide treatments would be similar to those under the other alternatives. No changes in populations and demography, or employment, would occur. The potential for disproportionate adverse effects to minority populations and children would continue to be low. The level of economic benefit associated with fuels reduction and control of noxious weeds would be similar to that under the other alternatives, as would the level of risk to commercial activities on public lands and adjacent private properties.

Use of aminopyralid under Alternative D would be the same as under the Preferred Alternative, and total use of the three pyridine carboxylic acids of particular concern would also be the same as under the Preferred Alternative. In all cases, risks could be avoided by adhering to the restrictions on the herbicide label.

Mitigation for Herbicide Treatment Impacts

The SOPs listed earlier in this section were designed to reduce potential adverse impacts to social and economic conditions from the application of herbicides. They would apply to all treatments involving aminopyralid, fluroxypyr, and rimsulfuron.

No mitigation measures are proposed for social and economic resources.

Human Health and Safety

The use of herbicides involves potential risk or the perception of risk to workers and members of the public living or engaging in activities in or near herbicide treatment areas. As part of the PEIS, an HHRA has been conducted to evaluate the potential human health risks of aminopyralid, fluroxypyr, and rimsulfuron as a result of herbicide exposure during and/or after treatment of public lands. The HHRA has been conducted to be scientifically defensible, to be consistent with currently available guidance where appropriate, and to meet the needs of the BLM vegetation treatment program.

The three new active ingredients may be used with one or more previously approved active ingredients, either as a formulation or a tank mix (see Section on Herbicide Formulations Used by the BLM and Tank Mixes in Chapter 2). The human health risks associated with the currently approved herbicides may be found in the 2007 PEIS (USDOI BLM 2007a:4-182 to 4-194). Only the three herbicides proposed for use are considered in this PEIS.

Scoping Comments and Other Issues Evaluated in the Assessment

The BLM received a few scoping comments expressing concerns about the health risks associated with herbicides. In particular, one comment stressed the need for additional preventative measures and oversight of existing SOPs to protect human health, after reports that an individual was sprayed during an aerial herbicide

application, and was not notified beforehand that the treatment would occur. Another comment indicated that the existing buffers between treatments and human habitation are not adequate. However, one comment also pointed out that risks associated with herbicides should be considered alongside the risks associated with other types of vegetation treatments that would be used if herbicides were not allowed. None of the comments specifically addressed the three active ingredients that are being considered in this PEIS.

Standard Operating Procedures

The 2007 PEIS lists SOPs that were designed by the BLM to reduce potential unintended impacts to human health from the application of herbicides. These SOPs would continue to apply to herbicide treatments involving aminopyralid, fluroxypyr, and rimsulfuron, and are considered when evaluating impacts to human health and safety:

- Establish a buffer between treatment areas and human residences based on guidance given in the HHRA, with a minimum buffer of ¼ mile for aerial applications and 100 feet for ground applications, unless a written waiver is granted.
- Use protective equipment as directed by the herbicide label.
- Post treated areas with appropriate signs at common public access areas.
- Observe restricted entry intervals specified by the herbicide label.
- Provide public notification in newspapers or other media where the potential exists for public exposure.
- Have a copy of MSDSs at work sites.
- Notify local emergency personnel of proposed treatments.
- Contain and clean up spills and request help as needed.
- Secure containers during transport.
- Follow label directions for use and storage.
- Dispose of unwanted herbicides promptly and correctly.

The results from the HHRA will help inform BLM field offices about the proper application of herbicides to ensure that impacts to humans are minimized to the extent practical.

Human Health Risk Assessment Methodology

The HHRA for aminopyralid, fluroxypyr, and rimsulfuron follows the same methodology as the HHRA for the 2007 PEIS (USDOI BLM 2007a:4-175 to 4-181), as discussed in detail in the HHRA. This methodology is summarized here.

The BLM HHRA follows the four-step risk assessment model identified by the National Academy of Sciences (1983). The steps are: 1) hazard identification, 2) dose-response assessment, 3) exposure assessment, and 4) risk characterization.

Hazard Identification

The hazard identification section provides information on the herbicide active ingredient characteristics and usage, and toxicity profiles. Both acute (short term) and chronic (longer term) toxicity information is considered. Acute toxicity endpoints include oral, inhalation, and dermal acute toxicity; eye irritation; skin irritation; and dermal acute toxicity. Acute toxicity endpoints include the median lethal dose (the dose that kills 50 percent of test animals), the dose at which no adverse effects were seen, and the lowest level at which adverse effects were seen.

Inert ingredients were considered in the HHRA for the 2007 PEIS. As the inert ingredients found in formulations of the three new herbicides would be the same as those previously considered, no additional analysis of these chemicals was done in the current HHRA. The previous HHRA found that the majority of inert ingredients are of minimal risk, and a few are in the category of unknown toxicity.

Dose-Response Assessment

The dose-response assessment identifies the types of adverse health effects an herbicide may potentially cause, and defines the relationship between the dose of an herbicide and the likelihood or magnitude of an adverse effect (response). Dose-response values are used to derive risk estimates. As none of the three herbicides evaluated are designated as potential carcinogens by the USEPA, the dose-response

assessment focuses on non-carcinogenic effects (i.e., potential toxic effects other than cancer).

Exposure Assessment

The exposure assessment predicts the magnitude and frequency of potential human exposure to the herbicides under consideration. The BLM takes care to prevent exposures to applied pesticides both through worker training programs and by posting areas that have just been sprayed with information on when reentry into these areas is appropriate. However, to be conservative, the HHRA has evaluated both routine use and accidental exposure scenarios. Additionally, exposures were evaluated both for applications using the maximum application rate designated by the herbicide label, and for applications using a typical application rate defined by BLM.

Occupational Exposure Scenarios. Routine exposures for occupational receptors include dermal and inhalation exposures that could occur by a worker during an application of the herbicide. For aerial applications, occupational receptors that may come into routine contact with herbicides include pilots and mixer/loaders. For ground applications by backpack, the occupational receptor is assumed to be an applicator/mixer/loader. For the remaining application methods (horseback, and spot and boom/broadcast methods for ATV/UTV and truck mount applications), applicators, mixer/loaders, and applicator/mixer/loaders were evaluated. The exposure dose was calculated using the herbicide application rate and the acres treated per day.

Accidental exposures for occupational receptors could occur via spills or direct spray onto a worker. As a worst-case scenario for an accidental exposure, a direct spill event on an occupational receptor was evaluated. The spill scenario assumes that 0.5 liter (½ quart) of the formulation is spilled on a worker receptor. It is assumed that 80 percent of the spill lands on clothing and 20 percent lands on bare skin. The penetration rate through clothing is assumed to be 30 percent. While some of the herbicide labels require the use of gloves while handling the herbicide, others do not. Therefore, this scenario assumes that gloves are not worn.

Public Use Exposure Scenarios. Public use exposure scenarios involve public receptors using public lands treated with herbicides. Public receptors include: 1) hikers/hunters; 2) berry pickers - child and adult; 3) anglers; 4) swimmers - child and adult; 5) nearby residents - child and adult; and 6) Native Americans - child and adult. Two types of scenarios are addressed:

- Routine-use exposure scenarios in which a public receptor is exposed to herbicide active ingredient(s) that have drifted outside the area of application. It is assumed that the public would heed posted signs and not enter a treatment area during the treatment.

- Accidental scenarios where public receptors may prematurely enter a sprayed area (a reentry scenario), be sprayed directly, or contact water bodies that have accidentally been sprayed directly or into which an herbicide active ingredient has accidentally been spilled.

These public exposure scenarios are thought to be unlikely and represent worst-case conditions. Potential exposure pathways include: 1) dermal contact with spray, 2) dermal contact with foliage, 3) dermal contact with water while swimming, 4) ingestion of drinking water or incidental ingestion of water while swimming, 5) ingestion of berries, and 6) ingestion of fish.

Risk Characterization

The risk characterization estimates of the potential risk to human health from exposure to herbicides. The results of the exposure assessment are combined with the results of the dose-response assessment to derive quantitative estimates of risk. For the noncarcinogenic active ingredients evaluated in this HHRA, risk is described simply by the comparison of the exposure doses to the appropriate dose-response values.

The Aggregate Risk Index (ARI) is a numeric expression of risk that combines potential risks from various exposure pathways, as discussed in more detail in the HHRA (AECOM 2014d). The ARI is compared against a target value of 1. An ARI that is greater than 1 does not exceed the USEPA's level of concern, and indicates that no adverse health effects are expected. An ARI below 1 indicates a potential concern for human health.

Uncertainty in the Risk Assessment Process

The HHRA incorporates various conservative assumptions to compensate for uncertainties in the risk assessment process. Conservative assumptions are made throughout the risk assessment process, since every assumption introduces some degree of uncertainty into the process. Using conservative assumptions

exaggerates the risks to err on the side of protecting human health.

Human Health Risks Associated with Herbicides

The types of potential impacts to human health and safety associated with herbicide use in general are discussed in the 2007 PEIS (USDOI BLM 2007a:4-181 to 4-182). This general analysis would continue to apply to herbicide treatments involving aminopyralid, fluroxypyr, and rimsulfuron. It is summarized here, followed by a more detailed analysis specific to the three new active ingredients.

Herbicides can be toxic to humans to varying degrees (any chemical poses a health risk at a high enough dose). Most clinical reports of herbicide effects are of skin and eye irritation. Short-term effects of exposure to herbicides include nausea, dizziness, or reversible abnormalities of the nervous system. In extreme cases of prolonged, repeated, and excessive exposure, longer-term health problems can result, including: organ damage, immune system damage, permanent nervous system damage, production of inheritable mutations, damage to developing offspring, and reduction of reproductive success. The label instructions of each herbicide provide restrictions and precautions on usage that minimize the risk of these effects. As part of registration of herbicides, the USEPA adheres to a uniform, health-based standard to ensure a "reasonable certainty of no harm" to consumers.

The greatest risk for occupational exposure to herbicides occurs when workers must directly handle and/or mix chemicals. Spot and localized applications, which require the most hands-on use of herbicides, carry the greatest risk of exposure. Workers can also be exposed to herbicides from accidental spills, splashing, leaking equipment, contact with spray, or by entering treated areas. Exposure can occur either through skin or through inhalation. Adherence to operational safety guidelines, use of protective clothing, equipment checks, and personal hygiene can prevent incidents from occurring. The herbicide label and corresponding MSDSs detail these application requirements in addition to safety guidelines.

Public receptors can be exposed to herbicides by being accidentally sprayed, by entering areas soon after treatment (e.g., eating berries or other foods, and touching vegetation), drinking contaminated water, or accidentally coming into contact with herbicides that have drifted downwind. Members of the general public, both visitors and residents, are less likely to be repeatedly exposed than vegetation management workers. The BLM has SOPs in place to prevent exposure of the public to treated areas. However, there has been one documented account of an accidental spraying (via drift) of a worker engaged in other resource work at the same time as an aerial herbicide application in Nevada. The findings of this incident indicate that both the contractor doing the spraying and the BLM failed to implement SOPs that would have prevented this occurrence. While the BLM has taken steps to ensure that SOPs are followed in the future, the incident shows that even with SOPs in place, accidental exposures to herbicides can occur.

Tables 4-14 and 4-15 are summary tables that show the level of risk each receptor (occupational and public) would face during the application of a given herbicide, for both maximum and typical application rate scenarios. ARIs are partitioned into no, low, moderate, and high levels of risk for ease of comparison (no risk is identified as an ARI greater than 1, low risk is between 1 and 0.1, moderate risk is between 0.1 and 0.01, and high risk is less than 0.01). These designations are strictly for comparison purposes, and do not imply actual risks to people. Tables 4-16 through 4-24 present more detailed tables of ARIs for each herbicide and receptor under occupational and public exposure scenarios. Based on the HHRA (AECOM 2014d), the three herbicides generally pose very little risk to human health, with rimsulfuron posing some risk to occupational receptors under accidental exposure scenarios.

Aminopyralid

Based on the hazard identification presented in the HHRA, aminopyralid has low acute toxicity via oral, dermal, and inhalation routes of exposure, but may cause severe eye irritation in some forms. At mid- and high-level doses, adverse effects to the stomach, ileum, and cecum have been noted. Developmental and reproduction studies indicate no evidence that fetuses or offspring have increased susceptibility to aminopyralid. Aminopyralid has been classified as "not likely to be carcinogenic to humans," and there is no evidence that it is mutagenic or an endocrine disrupter (USEPA 2009b).

TABLE 4-14
Herbicide Risk Categories by Aggregate Risk Index for Occupational Receptors

Receptor	Aminopyralid			Fluroxypyr			Rimsulfuron			
	Typ[1]	Max[1]	Accid[1]	Typ	Max	Accid	Typ	Max	Accid	
									Typ[2]	Max[2]
Plane - pilot	0[3]	0	NC	0	0	NC	0	0	L	M
Plane - mixer/loader	0	0	NC	0	0	NC	0	0	L	M
Helicopter - pilot	0	0	NC	0	0	NC	0	0	L	M
Helicopter - mixer/loader	0	0	NC	0	0	NC	0	0	L	M
Human/backpack - applicator/mixer/loader	0	0	NC	0	0	NC	0	0	L	M
Human/horseback - applicator/mixer/loader	0	0	NC	0	0	NC	0	0	L	M
ATV/UTV - applicator[4]	0	0	NC	0	0	NC	0	0	L	M
ATV/UTV - mixer/loader	0	0	NC	0	0	NC	0	0	L	M
ATV/UTV - applicator/mixer/loader	0	0	NC	0	0	NC	0	0	L	M
Truck - applicator[4]	0	0	NC	0	0	NC	0	0	L	M
Truck - mixer/loader	0	0	NC	0	0	NC	0	0	L	M
Truck - applicator/mixer/loader	0	0	NC	0	0	NC	0	0	L	M

[1] As a main heading: Typ = Typical application rate; Max = Maximum application rate; and Accid = Accidental rate. Typical and maximum application rate categories include short-, intermediate-, and long-term exposures. Accidental scenario category includes accidents with herbicide mixed at both the typical and maximum application rates and with a concentrated herbicide.
[2] As a subheading of the Accidental scenario category: Typ = solution mixed for the typical application rate; and Max = solution mixed for the maximum application rate.
[3] Risk categories: 0 = No risk (majority of ARIs > 1); L = Low risk (majority of ARIs <1 but >0.1); M = Moderate risk (majority of ARIs < 0.1 but > 0.01); and NC = Not calculated. The reported risk category represents the typical/most common risk level for estimated risks from various time periods. See Tables 4-16, 4-19 and 4-22 for the range of risk levels for each scenario. Accidental scenario ARIs were not calculated for aminopyralid or fluroxypyr because accidental scenarios assume a spill directly onto the receptor and aminopyralid and fluroxypyr are not toxic via the dermal route of exposure.
[4] ATV/UTV and Truck categories include spot and boom/broadcast application scenarios.

TABLE 4-15
Herbicide Risk Categories by Aggregate Risk Index for Public Receptors

Receptor	Aminopyralid			Fluroxypyr			Rimsulfuron		
	Typ[1]	Max[1]	Accid[1]	Typ	Max	Accid	Typ	Max	Accid
Hiker/hunter (adult)	NC	NC	NC	NC	NC	NC	0[2]	0	0
Berry picker (child)	NC	NC	NC	NC	NC	NC	0	0	0
Berry picker (adult)	NC	NC	NC	NC	NC	NC	0	0	0
Angler (adult)	NC	NC	NC	NC	NC	NC	0	0	0
Residential (child)	NC	NC	NC	NC	NC	NC	0	0	0
Residential (adult)	NC	NC	NC	NC	NC	NC	0	0	0
Native American (child)	0	0	0	0	0	0	0	0	0
Native American (adult)	0	0	0	0	0	0	0	0	0
Swimmer (child)	0	0	0	0	0	0	NC	NC	NC
Swimmer (adult)	0	0	0	0	0	0	NC	NC	NC

[1] As a main heading: Typ = Typical application rate; Max = Maximum application rate; and Accid = Accidental rate. Typical and maximum application rate categories include short-, intermediate-, and long-term exposures. Accidental scenario category includes accidents with herbicide mixed at both the typical and maximum application rates and with a concentrated herbicide.
[2] Risk categories: 0 = No risk (majority of ARIs > 1); and NC = Not calculated. The reported risk category represents the typical/most common risk level for estimated risks from various time periods. See Tables 4-17, 4-18, 4-20, 4-21, 4-23, and 4-24 for the range of risk levels for each scenario. For aminopyralid and fluroxypyr, no dose-response.
values are available for dermal exposure or acute dietary exposure due to low toxicity. For rimsulfuron, no dose-response values are available for the incidental oral pathway due to use pattern.

TABLE 4-16
Aminopyralid Aggregate Risk Indices – Occupational Scenarios

Application Type	Application Vehicle	Application Method	Receptor[1]	Typical Application Rate Scenario ARIs			Maximum Application Rate Scenario ARIs			Accidental Scenario ARIs (Short-term Dermal)
				Short-term	Intermediate-term	Long-term	Short-term	Intermediate-term	Long-term	Concentrated Solution[2]
Aerial	Plane	Fixed Wing	Pilot	15,588	15,588	NC	3,684	3,684	NC	NC
Aerial	Plane	Fixed Wing	Mixer/Loader	3,643	3,643	NC	861	861	NC	NC
Aerial	Helicopter	Rotary	Pilot	38,971	38,971	NC	9,211	9,211	NC	NC
Aerial	Helicopter	Rotary	Mixer/Loader	9,107	9,107	NC	2,125	2,152	NC	NC
Ground	Human	Backpack	Applicator/Mixer/Loader	684,755	684,755	NC	121,388	121,388	NC	NC
Ground	Human	Horseback	Applicator/Mixer/Loader	91,301	91,301	NC	36,416	36,416	NC	NC
Ground	ATV/UTV	Spot	Applicator	217,436	217,436	NC	42,828	42,828	NC	NC
Ground	ATV/UTV	Spot	Mixer/Loader	4,856,816	4,856,816	NC	860,981	860,981	NC	NC
Ground	ATV/UTV	Spot	Applicator/Mixer/Loader	202,338	202,338	NC	39,855	39,855	NC	NC
Ground	ATV/UTV	Boom/Broadcast	Applicator	779,412	779,412	NC	153,520	153,520	NC	NC
Ground	ATV/UTV	Boom/Broadcast	Mixer/Loader	1,517,755	1,517,755	NC	322,868	322,868	NC	NC
Ground	ATV/UTV	Boom/Broadcast	Applicator/Mixer/Loader	419,968	419,968	NC	82,721	82,721	NC	NC
Ground	Truck Mount	Spot	Applicator	119,208	119,208	NC	19,273	19,273	NC	NC
Ground	Truck Mount	Spot	Mixer/Loader	2,396,455	2,396,455	NC	322,868	322,868	NC	NC
Ground	Truck Mount	Spot	Applicator/Mixer/Loader	110,931	110,931	NC	17,935	17,935	NC	NC
Ground	Truck Mount	Boom/Broadcast	Applicator	415,686	415,686	NC	122,816	122,816	NC	NC
Ground	Truck Mount	Boom/Broadcast	Mixer/Loader	809,469	809,469	NC	191,329	191,329	NC	NC
Ground	Truck Mount	Boom/Broadcast	Applicator/Mixer/Loader	223,983	223,983	NC	66,177	66,177	NC	NC

[1] Receptor refers to a single worker doing all of the listed tasks.
[2] Based on the assumption that a spill of concentrated liquid occurs to worker skin.
ARI = Aggregate Risk Index. ARI is based on inhalation exposure because based on the toxicity assessment, dermal exposure is not of concern. Values less than 1 represent a level of concern.
ATV = All-terrain vehicle.
UTV = Utility terrain vehicle.
NC = Not calculated. Based on toxicity assessment, dermal exposure is not of concern, and long-term inhalation is not a concern for seasonal treatment.

TABLE 4-17
Aminopyralid Aggregate Risk Indices, Routine Exposure Scenarios for Public Receptors, Short-term Exposure

	Typical Application Rate Scenario ARIs						Maximum Application Rate Scenario ARIs					
AgDrift Scenario	**Aerial**	**Aerial**	**Aerial**	**Aerial**	**Ground**	**Ground**	**Aerial**	**Aerial**	**Aerial**	**Aerial**	**Ground**	**Ground**
Land Type[1]	**Non-forested**	**Non-forested**	**Forested**	**Forested**	**NA**	**NA**	**Non-forested**	**Non-forested**	**Forested**	**Forested**	**NA**	**NA**
Equipment	**Plane**	**Helicopter**	**Plane**	**Helicopter**	**Low Boom**	**High Boom**	**Plane**	**Helicopter**	**Plane**	**Helicopter**	**Low Boom**	**High Boom**
Hiker/Hunter (Adult)	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Berry Picker (Child)	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Berry Picker (Adult)	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Angler (Adult)	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Residential (Child)	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Residential (Adult)	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Native American (Child)	9,894,117	9,904,690	9,812,094	9,950,628	9,951,298	9,946,385	7,013,584	7,021,934	6,957,082	7,055,988	7,056,377	7,052,925
Native American (Adult)	19,227,567	19,248,114	19,068,170	19,337,386	19,338,688	19,329,142	13,629,732	13,645,958	13,519,929	13,712,136	13,712,892	13,706,184
Swimmer (Child)	1,982	1,984	1,966	1,994	1,994	1,993	1,405	1,407	1,394	1,414	1,414	1,413
Swimmer (Adult)	17,752	17,771	17,605	17,853	17,855	17,846	12,584	12,599	12,482	12,660	12,660	12,65

[1] Land type is not applicable to ground scenarios.
ARI = Aggregate Risk Index. Values less than 1 represent a level of concern. ARI does not include dietary or dermal exposure due to low toxicity. ARIs are based on swimming exposure.
NA = Not applicable.
NC = Not calculated. No dose-response values are available for dermal exposure or acute dietary exposure due to low toxicity.

TABLE 4-18
Aminopyralid Aggregate Risk Indices for Accidental Exposure Scenarios for Public Receptors Based on Maximum Application Rates

Receptor	Dermal Contact Exposure Pathways					Dietary Exposure Pathways						
	Direct Spray of Receptor	Dermal Contact with Foliage	Swimming[1]			Drinking Water Ingestion			Fish Ingestion			Berry Ingestion
			Spray of Water Body[2]	Helicopter Spill	Truck Spill	Spray of Water Body	Helicopter Spill	Truck Spill	Spray of Water Body[2]	Helicopter Spill	Truck Spill	
Angler	NC	NC	--	--	--	NC	NC	NC	NC	NC	NC	--
Berry Picker (Adult)	NC	NC	--	--	--	NC	NC	NC	--	--	--	NC
Berry Picker (Child)	NC	NC	--	--	--	NC	NC	NC	--	--	--	NC
Hiker/Hunter	NC	NC	--	--	--	NC	NC	NC	--	--	--	--
Native American (Adult)	NC	NC	102,250,368	912,950	3,195,324	NC	NC	NC	NC	NC	NC	NC
Native American (Child)	NC	NC	52,615,970	469,785	1,644,249	NC	NC	NC	NC	NC	NC	NC
Residential (Adult)	NC	NC	--	--	--	--	--	--	--	--	--	--
Residential (Child)	NC	NC	--	--	--	--	--	--	--	--	--	--
Swimmer (Adult)	--	--	94,403	843	2,950	--	--	--	--	--	--	--
Swimmer (Child)	--	--	10,542	94	329	--	--	--	--	--	--	--

[1] Includes incidental ingestion for the swimmer. Incidental ingestion is not included for the Native American pathway because the drinking water pathway is included.
[2] Assumes accidental spray of water body.
-- = Receptor not exposed via this pathway.
ARI = Aggregate Risk Index. Values less than 1 represent a level of concern.
NC = cot calculated. No dose-response values available.

TABLE 4-19
Fluroxypyr Aggregate Risk Indices – Occupational Scenarios

Application Type	Application Vehicle	Application Method	Receptor[1]	Typical Application Rate Scenario ARIs			Maximum Application Rate Scenario ARIs			Accidental Scenario ARIs (Short-term Dermal)
				Short-term	Intermediate-term	Long-term	Short-term	Intermediate-term	Long-term	Concentrated Solution[2]
Aerial	Plane	Fixed Wing	Pilot	4,497	4,497	4,497	779	779	779	NC
Aerial	Plane	Fixed Wing	Mixer/Loader	1,051	1,051	1,051	182	182	182	NC
Aerial	Helicopter	Rotary	Pilot	11,242	11,242	11,242	1,949	1,949	1,949	NC
Aerial	Helicopter	Rotary	Mixer/Loader	2,627	2,627	2,627	455	455	455	NC
Ground	Human	Backpack	Applicator/Mixer/Loader	197,525	197,525	197,525	25,678	25,678	25,678	NC
Ground	Human	Horseback	Applicator/Mixer/Loader	26,337	26,337	26,337	7,703	7,703	7,703	NC
Ground	ATV/UTV	Spot	Applicator	62,722	62,722	62,722	9,060	9,060	9,060	NC
Ground	ATV/UTV	Spot	Mixer/Loader	1,401,004	1,401,004	1,401,004	182,131	182,131	182,131	NC
Ground	ATV/UTV	Spot	Applicator/Mixer/Loader	58,367	58,367	58,367	8,431	8,431	8,431	NC
Ground	ATV/UTV	Boom/Broadcast	Applicator	224,830	224,830	224,830	32,475	32,475	32,475	NC
Ground	ATV/UTV	Boom/Broadcast	Mixer/Loader	437,814	437,814	437,814	68,299	68,299	68,299	NC
Ground	ATV/UTV	Boom/Broadcast	Applicator/Mixer/Loader	121,145	121,145	121,145	17,499	17,499	17,499	NC
Ground	Truck Mount	Spot	Applicator	34,387	34,387	34,387	4,077	4,077	4,077	NC
Ground	Truck Mount	Spot	Mixer/Loader	691,285	691,285	691,285	68,299	68,299	68,299	NC
Ground	Truck Mount	Spot	Applicator/Mixer/Loader	31,999	31,999	31,999	3,794	3,794	3,794	NC
Ground	Truck Mount	Boom/Broadcast	Applicator	119,910	119,910	119,910	25,980	25,980	25,980	NC
Ground	Truck Mount	Boom/Broadcast	Mixer/Loader	233,501	233,501	233,501	40,473	40,473	40,473	NC
Ground	Truck Mount	Boom/Broadcast	Applicator/Mixer/Loader	64,611	64,611	64,611	13,999	13,999	13,999	NC

[1] Receptor refers to a single worker doing all of the listed tasks.
[2] Based on the assumption that a spill of concentrated liquid occurs to worker skin.
ARI = Aggregate Risk Index. ARI is based on inhalation exposure because based on the toxicity assessment, dermal exposure is not of concern. Values less than 1 represent a level of concern.
ATV = All-terrain vehicle.
UTV = Utility terrain vehicle.
NC = Not calculated. Based on toxicity assessment, dermal exposure is not of concern, and long-term inhalation is not a concern for seasonal treatment.

TABLE 4-20
Fluroxypyr Aggregate Risk Indices, Routine Exposure Scenarios for Public Receptors, Short-term Exposure

	Typical Application Rate Scenario ARIs						Maximum Application Rate Scenario ARIs					
AgDrift Scenario	**Aerial**	**Aerial**	**Aerial**	**Aerial**	**Ground**	**Ground**	**Aerial**	**Aerial**	**Aerial**	**Aerial**	**Ground**	**Ground**
Land Type[1]	**Non-forested**	**Non-forested**	**Forested**	**Forested**	**NA**	**NA**	**Non-forested**	**Non-forested**	**Forested**	**Forested**	**NA**	**NA**
Equipment	**Plane**	**Helicopter**	**Plane**	**Helicopter**	**Low Boom**	**High Boom**	**Plane**	**Helicopter**	**Plane**	**Helicopter**	**Low Boom**	**High Boom**
Hiker/Hunter (Adult)	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Berry Picker (Child)	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Berry Picker (Adult)	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Angler (Adult)	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Residential (Child)	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Residential (Adult)	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Native American (Child)	1,072	975	1,044	1,090	1,086	1,082	556	558	542	567	565	562
Native American (Adult)	2,082	1,895	2,029	2,118	2,110	2,102	1,080	1,084	1,053	1,101	1,097	1,093
Swimmer (Child)	1,724	1,569	1,680	1,754	1,747	1,740	894	898	872	912	909	905
Swimmer (Adult)	4,776	4,347	4,653	4,858	4,840	4,821	2,477	2,487	2,414	2,526	2,517	2,507

[1] Land type is not applicable to ground scenarios.
ARI = Aggregate Risk Index. Values less than 1 represent a level of concern. ARI does not include dietary or dermal exposure due to low toxicity. ARIs are based on swimming exposure.
NA = Not applicable.
NC = Not calculated. No dose-response values are available for dermal exposure or acute dietary exposure due to low toxicity.

TABLE 4-21
Fluroxypyr Aggregate Risk Indices for Accidental Exposure Scenarios for Public Receptors Based on Maximum Application Rates

Receptor	Dermal Contact Exposure Pathways					Dietary Exposure Pathways						
	Direct Spray of Receptor	Dermal Contact with Foliage	Swimming[1]			Drinking Water Ingestion			Fish Ingestion			Berry Ingestion
			Spray of Water Body[2]	Helicopter Spill	Truck Spill	Spray of Water Body	Helicopter Spill	Truck Spill	Spray of Water Body[2]	Helicopter Spill	Truck Spill	
Angler	NC	NC	--	--	--	NC	NC	NC	NC	NC	NC	--
Berry Picker (Adult)	NC	NC	--	--	--	NC	NC	NC	--	--	--	NC
Berry Picker (Child)	NC	NC	--	--	--	NC	NC	NC	--	--	--	NC
Hiker/Hunter	NC	NC	--	--	--	NC	NC	NC	--	--	--	--
Native American (Adult)	NC	NC	1,027	9	32	NC	NC	NC	NC	NC	NC	NC
Native American (Child)	NC	NC	528	5	17	NC	NC	NC	NC	NC	NC	NC
Residential (Adult)	NC	NC	--	--	--	--	--	--	--	--	--	--
Residential (Child)	NC	NC	--	--	--	--	--	--	--	--	--	--
Swimmer (Adult)	--	--	2,355	21	74	--	--	--	--	--	--	--
Swimmer (Child)	--	--	850	8	27	--	--	--	--	--	--	--

[1] Includes incidental ingestion for the swimmer. Incidental ingestion is not included for the Native American pathway because the drinking water pathway is included.
[2] Assumes accidental spray of water body.
-- = Receptor not exposed via this pathway.
ARI = Aggregate Risk Index. Values less than 1 represent a level of concern.
NC = Not calculated. No dose-response values available.

TABLE 4-22
Rimsulfuron Aggregate Risk Indices – Occupational Scenarios

Application Type	Application Vehicle	Application Method	Receptor[1]	Typical Application Rate Scenario ARIs			Maximum Application Rate Scenario ARIs			Accidental Scenario ARIs (Short-term Dermal)	
				Short-term	Intermediate-term	Long-term	Short-term	Intermediate-term	Long-term	Mixed (Maximum) Solution[1]	Mixed (Typical) Solution[2]
Aerial	Plane	Fixed Wing	Pilot	87	87	NC	29	29	NC	**0.089**	**0.12**
Aerial	Plane	Fixed Wing	Mixer/Loader	4	4	NC	1.5	1.5	NC	**0.089**	**0.12**
Aerial	Helicopter	Rotary	Pilot	217	217	NC	7.2	7.2	NC	**0.089**	**0.12**
Aerial	Helicopter	Rotary	Mixer/Loader	11	11	NC	3.7	3.7	NC	**0.089**	**0.12**
Ground	Human	Backpack	Applicator/Mixer/Loader	94	94	NC	24	24	NC	**0.089**	**0.12**
Ground	Human	Horseback	Applicator/Mixer/Loader	13	13	NC	7	7	NC	**0.089**	**0.12**
Ground	ATV/UTV	Spot	Applicator	283	283	NC	79	79	NC	**0.089**	**0.12**
Ground	ATV/UTV	Spot	Mixer/Loader	5,978	5,978	NC	1,494	1,494	NC	**0.089**	**0.12**
Ground	ATV/UTV	Spot	Applicator/Mixer/Loader	262	262	NC	73	73	NC	**0.089**	**0.12**
Ground	ATV/UTV	Boom/Broadcast	Applicator	6,459	6,459	NC	1,794	1,794	NC	**0.089**	**0.12**
Ground	ATV/UTV	Boom/Broadcast	Mixer/Loader	1,868	1,868	NC	560	560	NC	**0.089**	**0.12**
Ground	ATV/UTV	Boom/Broadcast	Applicator/Mixer/Loader	955	955	NC	265	265	NC	**0.089**	**0.12**
Ground	Truck Mount	Spot	Applicator	155	155	NC	35	35	NC	**0.089**	**0.12**
Ground	Truck Mount	Spot	Mixer/Loader	2,950	2,950	NC	560	560	NC	**0.089**	**0.12**
Ground	Truck Mount	Spot	Applicator/Mixer/Loader	144	144	NC	33	33	NC	**0.089**	**0.12**
Ground	Truck Mount	Boom/Broadcast	Applicator	3,445	3,445	NC	1,435	1,435	NC	**0.089**	**0.12**
Ground	Truck Mount	Boom/Broadcast	Mixer/Loader	906	906	NC	332	332	NC	**0.089**	**0.12**
Ground	Truck Mount	Boom/Broadcast	Applicator/Mixer/Loader	509	509	NC	212	212	NC	**0.089**	**0.12**

[1] Receptor refers to a single worker doing all of the listed tasks.
[2] Based on the assumption that a spill of mixed solution occurs to worker skin.
ARI = Aggregate Risk Index. ARI is based on inhalation exposure because based on the toxicity assessment, dermal exposure is not of concern. Values less than 1 represent a level of concern. Bolded cells indicate scenarios with ARI values less than 1.
ATV = All-terrain vehicle.
UTV = Utility terrain vehicle.
NC = Not calculated. Based on toxicity assessment, dermal exposure is not of concern, and long-term inhalation is not a concern for seasonal treatment.

TABLE 4-23
Rimsulfuron Aggregate Risk Indices, Routine Exposure Scenarios for Public Receptors, Short-term Exposure

	Typical Application Rate Scenario ARIs						Maximum Application Rate Scenario ARIs					
AgDrift Scenario	**Aerial**	**Aerial**	**Aerial**	**Aerial**	**Ground**	**Ground**	**Aerial**	**Aerial**	**Aerial**	**Aerial**	**Ground**	**Ground**
Land Type[1]	**Non-forested**	**Non-forested**	**Forested**	**Forested**	**NA**	**NA**	**Non-forested**	**Non-forested**	**Forested**	**Forested**	**NA**	**NA**
Equipment	**Plane**	**Helicopter**	**Plane**	**Helicopter**	**Low Boom**	**High Boom**	**Plane**	**Helicopter**	**Plane**	**Helicopter**	**Low Boom**	**High Boom**
Hiker/Hunter (Adult)	252	305	59	713	2,139	1,426	178	225	47	535	1,426	328
Berry Picker (Child)	96	116	23	271	813	542	68	86	18	203	542	125
Berry Picker (Adult)	241	291	57	681	2,043	1,362	170	215	45	511	1,362	313
Angler (Adult)	252	305	59	713	2,139	1,426	178	225	47	535	1,426	328
Residential (Child)	79	95	19	222	667	445	56	70	15	167	445	102
Residential (Adult)	183	222	43	518	1,553	1,036	129	163	34	388	1,036	238
Native American (Child)	94	114	22	267	801	534	67	84	18	200	534	123
Native American (Adult)	236	285	56	667	2,000	1,333	167	210	44	500	1,333	307
Swimmer (Child)	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Swimmer (Adult)	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

[1] Land type is not applicable to ground scenarios.
ARI = Aggregate Risk Index. Values less than 1 represent a level of concern. ARI does not include dietary or dermal exposure due to low toxicity. ARIs are based on swimming exposure.
NA = Not applicable.
NC = Not calculated. No dose-response values are available for incidental oral pathway due to use pattern.

TABLE 4-24
Rimsulfuron Aggregate Risk Indices for Accidental Exposure Scenarios for Public Receptors Based on Maximum Application Rates

Receptor	Dermal Contact Exposure Pathways					Dietary Exposure Pathways						
	Direct Spray of Receptor	Dermal Contact with Foliage	Swimming[1]			Drinking Water Ingestion			Fish Ingestion			Berry Ingestion
			Spray of Water Body[2]	Helicopter Spill	Truck Spill	Spray of Water Body	Helicopter Spill	Truck Spill	Spray of Water Body[2]	Helicopter Spill	Truck Spill	
Angler	12	104	--	--	--	NC	NC	NC	NC	NC	NC	--
Berry Picker (Adult)	7	61	--	--	--	NC	NC	NC	--	--	--	NC
Berry Picker (Child)	3	35	--	--	--	NC	NC	NC	--	--	--	NC
Hiker/Hunter	7	104	--	--	--	NC	NC	NC	--	--	--	--
Native American (Adult)	7	51	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Native American (Child)	3	29	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Residential (Adult)	7	15	--	--	--	--	--	--	--	--	--	--
Residential (Child)	3	9	--	--	--	--	--	--	--	--	--	--
Swimmer (Adult)	--	--	NC	NC	NC	--	--	--	--	--	--	--
Swimmer (Child)	--	--	NC	NC	NC	--	--	--	--	--	--	--

[1] Includes incidental ingestion for the swimmer. Incidental ingestion is not included for the Native American pathway because the drinking water pathway is included.
[2] Assumes accidental spray of water body
-- = Receptor not exposed via this pathway.
ARI = Aggregate Risk Index. Values less than 1 represent a level of concern.
NC = Not calculated. No dose-response values available.

Dermal studies indicate that aminopyralid does not have significant toxicity via the dermal route of exposure, as it is either not absorbed or poorly absorbed through the skin. For this reason, ARIs were derived using oral and inhalation exposures.

As shown in Tables 4-14 and 4-15, there are no risks to occupational or public receptors from exposures resulting from routine use (typical or maximum application rate) or accidental scenarios. Tables 4-17 through 4-19 show the detailed HHRA results for aminopyralid, presenting ARIs by receptor and exposure scenario. ARIs for all receptors were all well above 1, with the lowest ARI of 94 for a child swimming in a water body following a helicopter spill (Table 4-18). This exposure pathway assumes incidental ingestion of water while swimming. These results indicate that aminopyralid does not present an unacceptable risk to occupational or public receptors, even under worst-case accidental exposure scenarios.

Fluroxypyr

Based on the hazard identification in the HHRA, fluroxypyr has low acute toxicity via oral and dermal routes, and moderate acute toxicity via inhalation. It is not irritating to the skin, but is a mild eye irritant. At high doses, it can target the kidney and result in other adverse health effects. There is no evidence of increased susceptibility following in utero, pre-natal, or post-natal exposure. Endocrine disruption studies have not been conducted. There is no indication that fluroxypyr is carcinogenic or mutagenic (USEPA 2007).

Based on studies involving subchronic dermal exposures of high doses of fluroxypyr, in which no effects were observed, the USEPA has determined that dermal risk assessment is not required for this chemical (USEPA 2007). Therefore, ARIs were derived using oral and inhalation exposures.

As shown in Table 4-14 and 4-15, and shown in more detail in Tables 4-20 and 4-21, there are no risks to occupational or public receptors from exposures resulting from routine use (typical or maximum application rate) or accidental scenarios. ARIs for all receptors were above 1, with the only ARIs below 500 for accidental exposures involving swimming in a water body following an accidental spill of fluroxypyr. These exposure pathways assume incidental ingestion of water while swimming (Table 4-21). The lowest ARI was for a Native American child swimming in a body of water following a helicopter spill. These results indicate that fluroxypyr does not present an unacceptable risk to occupational or public receptors, even under worst-case accidental exposure scenarios.

Rimsulfuron

Based on the hazard identification presented in the HHRA, rimsulfuron has low acute toxicity orally, by dermal exposure, and by inhalation, but is a moderate eye irritant. It is not a dermal sensitizer. Based on subchronic and chronic toxicity studies, long-term exposures to rimsulfuron can cause a variety of adverse health effects targeting multiple organs. No developmental toxicity has been observed at high doses, and there is no evidence that rimsulfuron is an endocrine disruptor. Rimsulfuron is classified as “Not Likely a Human Carcinogen” (USEPA 2011).

As shown in Table 4-14, there is no risk to occupational receptors under routine exposure scenarios, but low to moderate risk under accidental exposure scenarios. These scenarios assume that a mixed solution of rimsulfuron is spilled directly onto an occupational receptor, and that use of proper personal protective equipment (PPE) would not prevent dermal exposure. Therefore, this risk represents an unlikely scenario that could be avoided through proper handling of the herbicide, following all SOPs and label instructions, and use of appropriate PPE. Table 4-22 shows the detailed HHRA results for occupational exposure scenarios.

As summarized in Table 4-15, and shown in more detail in Tables 4-23 and 4-24, there is no risk to public receptors under routine or accidental exposure pathways. All of the calculated ARIs are above 1. The lowest ARIs were for accidental direct spray scenarios involving children. These results indicate that rimsulfuron does not present an unacceptable risk to public receptors, even under worst-case accidental exposure scenarios.

Impacts by Alternative

The following is a qualitative discussion of how risk from herbicide exposure would vary under each herbicide treatment alternative.

Alternative A – Continue Present Herbicide Use (No Action Alternative)

Under this alternative, the BLM would continue to implement herbicide treatments using the 18 herbicides previously approved in the 2007 PEIS. The total area treated with herbicides would be the same as under the action alternatives, so the only differences in risk would

pertain to the relative amount of different herbicides used, and their associated level of risk. Risks to humans from the use of the previously approved chemicals vary, ranging from no risk to high risk to occupational and public receptors, depending on the exposure scenario. Herbicides with the greatest amount of associated risk include 2,4-D, bromacil, diquat, fluridone, hexazinone, tebuthiuron, and triclopyr (see the 2007 PEIS for more information (USDOI BLM 2007a:4-182 to 4-193). Of these, the active ingredients with the greatest projected usage under this alternative include triclopyr, tebuthiuron, and 2,4-D. Human health risks from these chemicals would continue to be minimized by following all label instructions, and SOPs to prevent accidental exposures and protect human health. Additionally, the mitigation measures specified in the ROD for the 2007 PEIS (USDOI BLM 2007b:Table 2), such as using the typical application rate of these chemicals, where feasible, would help to further minimize risks to occupational and public receptors.

Under this alternative, ongoing treatment programs with the currently approved herbicides would continue to provide benefits to human health by reducing the occurrence of noxious weeds and other invasive vegetation. Additionally, ongoing treatment of species that increase the risk of wildfire, such as cheatgrass, would reduce the risk of wildfire and the associated public health and safety risks.

Alternative B – Allow for Use of Three New Herbicides in 17 Western States (Preferred Alternative)

Under the Preferred Alternative, general risks associated with herbicide treatments would be much the same as under the No Action Alternative, as roughly the same acreage would be treated with herbicides. The ability to use aminopyralid, fluroxypyr, and rimsulfuron for vegetation treatments could result in a slight change in risk in certain treatment areas, as the relative amount of herbicides would change. All three of the new herbicides have no to very low risk to human health (with an unacceptable risk only predicted for one accidental exposure scenario involving rimsulfuron). However, the three herbicides with the most substantial predicted decrease in usage under this alternative—imazapic, glyphosate, and picloram—also have no to low human health risks. Use of the herbicides with higher risk would likely remain at or near current levels. Therefore, there would be little difference in risks to human health and safety between Alternative B and the No Action Alternative.

Introduction of the three new herbicides may allow the BLM to be more efficient at controlling certain target noxious weeds and other invasive vegetation, which would have an associated health benefit. Use of rimsulfuron may allow for better control of cheatgrass, and an associated reduction in wildfire risk. These beneficial effects are expected to be minor.

Alternative C – No Aerial Application of New Herbicides

Under Alternative C, human health risks associated with herbicide treatments would be similar to those under Alternative B and the No Action Alternative. The new herbicides would not be applied aerially, eliminating certain exposure pathways for occupational and public receptors. According to the HHRA, ARIs for aerial application scenarios are generally lower than those for ground-based methods, indicating greater overall risk. However, there are no differences in risk categories between aerial and ground application, as shown in Tables 4-14 and 4-15. Additionally, restriction of aerial applications of the new chemicals would not reduce aerial spraying of herbicides, as different active ingredients would be used where aerial spraying is needed. For instance, to control cheatgrass, the currently approved imazapic would be used in aerial applications where rimsulfuron would have otherwise been used. Furthermore, the total area treated using herbicides would not differ from the other alternatives.

The relative use of the different chemicals would be slightly different than under the No Action and Preferred Alternatives, with use of the three new herbicides being lower than under the Preferred Alternative, and use of glyphosate, imazapic, and picloram falling between the levels estimated for the No Action and Preferred Alternatives. The relative amounts of the other herbicides used would be roughly the same as under the other alternatives. As the active ingredients with usage levels that would change are all generally no to low risk herbicides, overall risk from herbicide use would be similar to that under the other alternatives.

Being unable to aerially apply the new herbicides could affect the effectiveness of herbicide treatments to some degree, although the currently approved herbicides could still be used to control the target species via aerial methods. While less benefit to human health from control of noxious weeds and wildfire fuels is possible, the differences are expected to be minor, relative to the Preferred Alternative.

Alternative D – No Use of New Acetolactate Synthase-inhibiting Active Ingredients (No Rimsulfuron)

Under this alternative rimsulfuron would not be used, and as a result use of glyphosate and imazapic would be higher than under the other action alternatives, similar to the No Action Alternative. However, since the differences in relative projected use involve all no- to low-risk active ingredients, overall risks to human health associated with herbicide treatments would be similar to those under the other alternatives. Since the total area treated using herbicides is expected to be the same under all the alternatives, there would be little to no difference in human health risk associated with potential exposure to herbicides.

Under this alternative, the BLM would not be able to use rimsulfuron to control cheatgrass and other winter annual grasses. As there is evidence that rimsulfuron may be more effective than imazapic and glyphosate in certain situations, the human health benefits associated with cheatgrass removal could be slightly less under this alternative than under the Preferred Alternative. It is expected that this difference would be minor.

Mitigation

As discussed previously, herbicide treatments involving the new chemicals would continue to follow all of the applicable SOPs for herbicide treatments listed in the 2007 PEIS and earlier in this resource section. The ROD (USDOI BLM 2007b:Table 2) lists additional mitigation measures for herbicide applications that would also continue to be followed, although these measures are specific to currently approved herbicides and would not apply to the new herbicides, unless used in a mixture with one of the other active ingredients.

Given the safety of aminopyralid, fluroxypyr, and rimsulfuron to humans, no additional mitigation measures are recommended for herbicide treatments with these active ingredients.

Cumulative Effects Analysis

NEPA and its implementing guidelines require an assessment of the proposed project and other projects that have occurred in the past, are occurring in the present, or are likely to occur in the future, which together may have cumulative impacts that go beyond the impacts of the proposed project itself. According to the Act (40 CFR §1508.7 and 1508.25[a][2]):

"Cumulative impact is the impact on the environment which results from the incremental impact of the action when added to the 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. In addition, to determine the scope of Environmental Impact Statements, agencies shall consider cumulative actions, which when viewed with other proposed actions have cumulatively significant impacts and should therefore be discussed in the same impact statement."

The purpose of this cumulative effects analysis is to determine if the effects of BLM vegetation treatments with aminopyralid, fluroxypyr, and rimsulfuron have the potential to interact or accumulate over time and space, either through repetition or when combined with other effects, and under what circumstances and to what degree they might accumulate.

The 2007 PEIS provides a thorough cumulative effects analysis for the BLM's herbicide treatment program (USDOI BLM 2007a:4-197 to 4-246). Since the three new herbicides would be added to an existing program, with no change in goals or acres or areas treated, much of the 2007 analysis is inclusive of their use and does not warrant repetition here. The analysis presented here provides a general summary of the 2007 analysis, with updated information provided where available. Additionally, the analysis will include a discussion of the cumulative effects associated with adding the three new herbicide active ingredients to the BLM's list of approved active ingredients.

Structure of the Cumulative Effects Analysis

The structure of the cumulative effects analysis is described in the 2007 PEIS (USDOI BLM 2007a:4-197 to 4-201.

Class of Actions to be Analyzed – large, regional scale trends and issues that require integrated management across broad landscapes, and regional-scale trends and changes in the social and economic needs of people.

Appropriate Temporal Domain – The analysis period is from 1930 through 2057. This is the date that was identified in the 2007 PEIS. As the three new active ingredients are being incorporated into the treatment

programs identified in the 2007 PEIS, the analysis period remains the same.

Appropriate Spatial Domain – The analysis area includes public lands in 17 western states, as well as adjacent and nearby non-federal lands, depending on the resource area.

Set of Receptors to be Assessed – the physical, biological, and human systems discussed in Chapter 3 (Affected Environment).

Magnitude of Effects and Whether They are Accumulating – consider additive, countervailing, and synergistic effects, using quantitative (where possible) and qualitative analysis.

Resource Protection Measures and Other Information Considered in the Cumulative Effects Analysis

The resource protection measures considered in the 2007 cumulative effects analysis (USDOI BLM 2007a:4-201 to 4-202) are considered in the current analysis. They include SOPs, monitoring measures, and mitigation provided in the 2007 PEIS and PER (USDOI BLM 2007a:Chapter 2; USDOI BLM 2007c:Chapter 2). Additionally, they include all new mitigation measures that have been developed by the BLM for use of the three new herbicides, which can be found in Chapter 2 of this document.

Additionally, federal, state, local, and tribal resource management and monitoring programs that pertain to protection of environmental resources and restoration of impaired resources are also considered in the cumulative effects analysis. Regulatory programs exist for air quality, water quality, wetlands, Essential Fish Habitat, threatened and endangered species, and environmental justice.

Other pertinent information considered in the cumulative effects analysis includes the following:

- Mitigation and SOPs identified in 2007 PEIS would be more stringent than those required by the USEPA.
- The BLM would comply with existing and future regulations, including FLPMA.
- A site-specific NEPA analysis would be conducted prior to implementing vegetation treatments on public lands.

Analysis of Cumulative Effects by Resources

Air Quality

Past Effects and Their Accumulation

Past effects to air quality, and their accumulation, are discussed in the 2007 PEIS (USDOI BLM 2007a:4-202 to 203). They include emissions associated with wildfire and prescribed fire, vehicle exhaust, commercial and industrial land uses, and residential heating, among other sources.

Since the 2007 PEIS was released in 2007, the USDOI has begun to track GHG emissions, and in 2012 developed goals for reducing GHG emissions (USDOI BLM 2014f). Since 2008, the USDOI has reduced direct (vehicle) and certain indirect (e.g., purchased electricity) GHG emissions by 11.6 percent, and reduced other indirect greenhouse gas emissions (e.g., airline business travel) by 7.5 percent.

Nationwide, air quality has continued to improve since 2007. Between 1990 and 2000, air pollution decreased for PM_{10} (38 percent), lead (83 percent), NO_2 (45 percent), CO (73 percent), and SO_2 (75 percent). $PM_{2.5}$ concentrations decreased between 2001 and 2010, and ozone concentrations decreased between 2002 and 2010. Many toxic air pollutants also declined. Pollutants of primary concern continue to be PM and ozone. Greenhouse gas emissions continue to increase in the U.S.; they have increased by 7 percent since 1990 (USEPA 2012e).

Based on data from the National Interagency Fire Center, the annual number of wildfires between 1987 and 2012 has remained relatively steady, but the acreage burned and average size of fires has increased (EcoWest 2014). Therefore, wildfires continue to contribute to air pollution at increasing levels, although there is quite a bit of variability from year to year.

Future Effects and Their Accumulation

Future effects to air quality, and their accumulation, are discussed in the 2007 PEIS (USDOI BLM 2007a:4-202 to 203). The discussion focuses on fire-related impacts to air quality, which are a main source of concern in the area affected by the BLM's

vegetation treatments. Sources of air quality pollutants discussed in the preceding section, such as wildfire and vehicle emissions, will continue to contribute to cumulative air quality emissions. Contributions of GHG emissions will also be cumulative, and will potentially have an impact at a global scale by contributing to climate change. It is expected that in the future, air quality overall will continue to improve, although emissions associated with wildfire may continue to increase. Better vehicle emission standards, other regulations, and efforts by the EPA, local air agencies, and other agencies to reduce air quality emissions will all contribute to this improvement in air quality.

Based on current trends, it is expected that GHG emissions will continue to increase in the future, and will continue to contribute to climate change. Increased drought conditions in the western U.S. could, in turn, contribute to an increase in wildfire, which would contribute additional air quality pollutants to the atmosphere.

Efforts by the BLM, Forest Service, and other agencies to reduce the risk of wildfire on lands that they manage will help offset some of the impacts to air quality associated with wildfires. These programs are likely to be ongoing during the duration of the period of analysis covered by this analysis.

Contribution of Alternatives to Cumulative Effects

Because the acreage of public lands treated with herbicides would be the same under all of the alternatives, the contribution to air quality in terms of pollutants generated during treatments would also be the same under all the alternatives. Air quality emissions are directly correlated with treatment acreage, as they are correlated to number of vehicle miles driven. The geographic location of air quality impacts would also be the same under all the alternatives. Air quality emissions associated with treatment programs would be cumulative to other releases of criteria pollutants and GHGs within the geographic areas affected by treatments.

Long-term benefits to air quality from a reduction in wildfire risk would also be the same under all the alternatives.

Soil Resources

Past Effects and Their Accumulation

Past effects to soil resources and their accumulation are discussed in the 2007 PEIS (USDOI BLM 2007a:4-205). They are predominantly associated with natural resource extraction, renewable energy development, grazing, road construction, timber harvesting, OHV and other recreation use, agriculture, development, wildland fire, and natural disturbances.

Future Effects and Their Accumulation

Future effects to soil resources and their accumulation are discussed in the 2007 PEIS (USDOI BLM 2007a:4-205 to 4-206). The factors contributing to past effects to soil, as described in the previous paragraph, are ongoing in the West, and will continue to impact soil resources. Additionally, vegetation treatments by the BLM will contribute to short-term loss of soil functions, process, and productivity on nearly all treated land. Adverse effects to soil will be offset by watershed-level restoration treatments designed and implemented by the BLM and other federal agencies with large landholdings in the West. Numerous policies, programs, and initiatives have been proposed to restore soil productivity and improve the health of ecosystems by the BLM and other federal, state, and local land management entities. In addition, conservation programs and best management practices to reduce soil loss in agricultural areas have been developed and implemented during the past several decades. All efforts to reduce the spread of invasive vegetation, and to reduce the risk of wildfire, are expected to help maintain soil productivity and function.

Contribution of Alternatives to Cumulative Effects

Because the acreage of public lands treated with herbicides would be the same under all of the alternatives, the contribution to soil impacts in terms of losses in soil function and productivity would also be the same under all the alternatives. Countervailing effects associated with long-term improvement in soil function and productivity would also be similar under all the alternatives.

Under the No Action Alternative, the number of herbicides used by the BLM with the potential to impact soil resources would be 18. Under Alternatives B and C, three additional herbicides would be used, and under Alternative D, two additional herbicides would be used. It is expected that impacts associated with all of the herbicide active ingredients would be short-lived, as herbicides and their breakdown products would degrade over time. However, the ways in which these chemicals might interact and the potential for synergistic effects from use of multiple active ingredients are largely unknown. The action alternatives would result in a cumulative increase in the number of herbicide active ingredients with the potential to impact soil and soil organisms.

Water Resources and Quality

Past Effects and Their Accumulation

Past effects to water resources and their accumulation are discussed in the 2007 PEIS (USDOI BLM 2007a:4-207 to 4-208). They are predominantly associated with mining activities, exploration and development of oil resources, agriculture (including use of pesticides), industry, and other human activities.

Based on the most recent (2004) National Water Quality Inventory Report to Congress (USEPA 2009a), an assessment of streams in the western U.S. determined that the most prevalent stressors were nitrogen, phosphorus, riparian disturbance, and streambed sediments.

Based on the most recent Alaska Water Quality Assessment Report (USEPA 2010b), the primary causes of impairment are turbidity, fecal coliform, and sedimentation/siltation, with resource extraction and urban runoff/stormwater as the primary sources of impairment.

Groundwater and surface water quality in the West have been impacted by pollutants associated with agriculture and other activities. Additionally, water quantity has been impacted in many areas of the West, largely as a result of ongoing population growth and irrigation. As documented by the NAWQA, pesticides or their degradates are prevalent in streams, and have been detected in more than half of the shallow wells sampled in agricultural and urban areas, and in 33 percent of the deeper wells that tap major aquifers (USGS 2006). About 1 percent of public-supply wells sampled by NAWQA had a pesticide concentration greater than a human health benchmark.

According to a recent study documenting trends in pesticide concentrations in U.S. streams and rivers, the proportion of mixed land use streams with pesticides exceeding aquatic life benchmarks has generally stayed the same over the last 20 years, with concentrations of individual pesticides varying in response to shifts in use patterns (Stone et al. 2014).

Future Effects and Their Accumulation

Future effects to water resources and their accumulation are discussed in the 2007 PEIS (USDOI BLM 2007a:4-208).

While it is difficult to predict the extent and magnitude of future effects to water resources and quality, it is assumed that activities that contribute to water quality pollution and depletion will continue in the western states. At the same time, efforts to improve water quality are ongoing, including goals by the BLM for percent of water bodies meeting State Water Quality Standards. Target goals are raised every year. The BLM and other land management agencies also continue programs to restore degraded wetland/riparian areas, which includes vegetation management programs. Programs that will be implemented to meet restoration goals are the same as those that were discussed in the 2007 PEIS.

Contribution of Alternatives to Cumulative Effects

Because the acreage of public lands treated with herbicides would be the same under all of the alternatives, the impacts to water resources in terms of degradation of water quality associated with treatments also would be the same under all the alternatives. Countervailing effects associated with long-term improvement in function of wetlands, riparian areas, streams, and other water bodies would also be similar under all the alternatives.

Under the No Action Alternative, the number of herbicides used by the BLM with the potential to impact water resources would be 18. Under Alternatives B and C, three additional herbicides would be used, and under Alternative D, two additional herbicides would be used. It is expected that impacts associated with all of the herbicide active ingredients would be short-lived, as herbicides and their breakdown products would degrade over time. However, the ways in which these chemicals might interact and the potential for synergistic effects from use of multiple active ingredients are largely unknown. Additionally, it is unknown the degree to which these degradates might persist in groundwater.

The action alternatives would result in a cumulative increase in the number of herbicide active ingredients with the potential to impact water resources and result in groundwater contamination.

Wetland and Riparian Areas

Past Effects and Their Accumulation

Past effects to wetland and riparian areas and their accumulation are discussed in the 2007 PEIS (USDOI BLM 2007a:4-209 to 4-210). They are predominantly associated with natural resource extraction, recreation, dams and diversions, road construction, agriculture, urbanization, and fire exclusion. Invasive plants and catastrophic wildfires degrade wetland and riparian function. Wetland losses in the lower 48 states have continued to decline, although the rate has been slowed by reestablishment of wetlands. Estimated net wetland loss for the lower 48 states from 2004 to 2009 was 62,300 acres (USFWS 2011). However, most of these wetlands were in the southeastern United States.

On BLM lands in the lower 48 states, 44 percent of wetlands surveyed are not functioning properly or are functioning at risk (USDOI BLM 2012a). This percentage continues to increase, despite efforts by the BLM to improve proper functioning condition. Only 16 percent of riparian areas in the lower 48 states are non-functional or functioning at risk, and the trend on BLM lands is one of improvement in riparian condition. In Alaska, impacts have been less, and nearly all wetlands and riparian areas are in properly functioning condition.

Future Effects and Their Accumulation

Future effects to wetlands and riparian areas and their accumulation are discussed in the 2007 PEIS (USDOI BLM 2007a:4-210).

Factors that contribute to degradation of wetlands and riparian areas, as described in the previous section, continue to varying degrees in the West. Climate change may also contribute to impacts, particularly as a result of increased temperatures and extended drought periods. Ongoing efforts to protect wetlands and riparian areas have reduced the level of impact of natural and human factors that degrade these habitats. Additionally, vegetation treatment programs by the BLM and Forest Service, along with restoration efforts by other agencies, private landowners, and other entities, continue to improve the condition of degraded wetland and riparian habitats. While it is difficult to predict the extent and magnitude of future effects to water resources and quality, it is assumed that activities that contribute to water quality pollution and depletion will continue in the western states. At the same time, efforts to improve water quality are ongoing, including goals by the BLM for percent of water bodies meeting State Water Quality Standards, which increase each year. The BLM and other land management agencies also continue programs to restore degraded wetland/riparian areas, which includes vegetation treatment programs. Future treatment programs that will be implemented to meet restoration goals are the same as those that were discussed in the 2007 PEIS.

Contribution of Alternatives to Cumulative Effects

Because the acreage of public lands treated with herbicides would be the same under all of the alternatives, potential impacts to wetlands and riparian areas associated with herbicide treatments would be the same under all the alternatives. Some herbicides would be released into wetland and riparian areas, and removal of vegetation could have short-term impacts to functions. Countervailing effects associated with long-term improvement in function of wetlands, riparian areas, streams, and other water bodies would also be similar under all the alternatives.

Under the No Action Alternative, the number of herbicides used by the BLM with the potential to impact water resources would be 18. Under Alternatives B and C, three additional herbicides would be used, and under Alternative D, two additional herbicides would be used. It is expected that impacts associated with all of the herbicide active ingredients would be short-lived, as herbicides and their breakdown products would degrade over time. However, the ways in which these chemicals might interact and the potential for synergistic effects from use of multiple active ingredients are largely unknown. Additionally, it is unknown the degree to which these degradates might persist in groundwater or wetland or riparian soils. The action alternatives would result in a cumulative increase in the number of herbicide active ingredients with the potential to impact wetland and riparian habitats and the species found in them.

Vegetation

Past Effects and Their Accumulation

Past effects to vegetation (including native plant communities and special status plant species), and their accumulation, are discussed in the 2007 PEIS (USDOI BLM 2007a:4-211 to 4-212). They are predominantly

associated with exclusion of fire and alteration of natural disturbance regimes, timber harvest, reseeding and planting programs, and grazing. Human activities have altered native plant communities, and have led to the introduction and spread of invasive species.

Future Effects and Their Accumulation

Future effects to vegetation, and their accumulation, are discussed in the 2007 PEIS (USDOI BLM 2007a:4-212 to 4-213). Many of the same human activities that have altered native plant communities in the past will continue to do so in the future. Populations of invasive species will continue to spread, and altered disturbance regimes will continue to cause large, wildfires that further alter vegetation in the western U.S. Treatments by the BLM, Forest Service, and other entities to remove hazardous fuels and control invasive species will help offset these adverse effects, although multiple treatments followed by restoration would be necessary to recover native communities and restore disturbance regimes in targeted areas.

Contribution of Alternatives to Cumulative Effects

Because the acreage of public lands treated with herbicides would be the same under all of the alternatives, the contribution to vegetation impacts in terms of departure from native conditions and disturbance regimes would also be the same under all the alternatives. Countervailing effects associated with long-term improvement in plant communities and reduction in fire risk would also be similar under all the alternatives.

Under the No Action Alternative, the number of herbicides used by the BLM with the potential to impact vegetation would be 18. Under Alternatives B and C, three additional herbicides would be used, and under Alternative D, two additional herbicides would be used. Under all alternatives, herbicides would be available that would allow the BLM to meet their treatment goals to restore native communities. The action alternatives would allow the BLM additional options for treating invasive species that could improve the effectiveness of treatment programs in certain circumstances. In all cases, herbicide treatments could be used in concert with other vegetation treatment methods. Additionally, aminopyralid and fluroxypyr would be tank mixed with other active ingredients, which could result in additive or even synergistic effects to non-target plants.

Fish and Other Aquatic Organisms

Past Effects and Their Accumulation

Past effects to fish and other aquatic resources (including special status aquatic species), and their accumulation, are discussed in the 2007 PEIS (USDOI BLM 2007a:4-214 to 4-215). They are predominantly associated with natural resource extraction; recreation; fire exclusion; construction of roads, dams, and hydropower facilities; agriculture; and urbanization. In Alaska, oil and gas development, and subsistence and recreational fishing, have been the primary factors affecting fish and aquatic resources.

The spread of invasive plant species and increase in catastrophic wildfires in the western U.S. have also been a factor in the degradation of water bodies that provide habitat for fish and other aquatic organisms.

The BLM, other federal and state agencies, private landowners, and businesses have implemented pest and invasive plant control efforts that have resulted in the application of thousands of tons of herbicides and other pesticides to the environment. Some of these pesticides break down relatively quickly in the environment or are not aquatic to organisms at typical application rates. However, some are harmful to aquatic organisms and may be persistent in the environment.

Future Effects and Their Accumulation

Future effects to fish and other aquatic resources, and their accumulation, are discussed in the 2007 PEIS (USDOI BLM 2007a:4-215). As discussed under the cumulative effects discussions for water resources, wetlands, and riparian areas, it is assumed that activities that contribute to the degradation and loss of these habitats will continue to occur in the western states, although they will be offset to some degree by protective regulations and restoration efforts, driven by goals to improve water quality and regain the proper functioning condition of riparian areas. Additionally, efforts to remove dams and other blockages to fish passage will continue to benefit fish populations by expanding their ranges.

Contribution of Alternatives to Cumulative Effects

Because the acreage of public lands treated with herbicides would be the same under all of the alternatives, the impacts to habitats that support fish and aquatic resources would also be much the same under all the alternatives. Countervailing effects associated

with long-term improvement in function of aquatic habitats would also be similar under all the alternatives.

Under the No Action Alternative, the number of herbicides used by the BLM with the potential to impact water resources would be 18. Under Alternatives B and C, three additional herbicides would be used, and under Alternative D, two additional herbicides would be used. The potential toxicological effects to fish and aquatic invertebrates associated with the active ingredients vary. By allowing the BLM the option of using additional active ingredients, the action alternatives would result in a cumulative increase in the number of active ingredients released to the environment that could enter aquatic habitats. As the three herbicides have a very low risk to aquatic species, a cumulative effect of adding these active ingredients could be a reduction in overall risk to aquatic species associated with herbicide use.

It is expected that impacts associated with all of the herbicide active ingredients would be short-lived, as herbicides and their breakdown products would degrade over time. However, the ways in which these chemicals might interact and the potential for synergistic effects from use of multiple active ingredients are largely unknown. Additionally, it is unknown the degree to which these degradates might persist in aquatic habitats.

Wildlife Resources

Past Effects and Their Accumulation

Past effects to wildlife and their accumulation are discussed in the 2007 PEIS (USDOI BLM 2007a:4-216 to 4-220). The discussion considers habitat loss, modification, and fragmentation, and wildlife health. Habitat loss has occurred as a result of conversion to agriculture, pastureland, and residential, commercial industrial, and other development. On lands that have not been converted to other uses, including most of the lands managed by the BLM, habitat modification has reduced their value to wildlife. The primary factors contributing to habitat modification in the West include grazing by domestic livestock and wild horses and burros, timber management, fire suppression, and invasion by invasive plants and other unwanted vegetation. Mature forests, sagebrush habitats, and grasslands have been most affected. Causes of wildlife death, injury, sickness, and disturbance include hunting, collisions with vehicles and structures, wildland and prescribed fires, recreation, and pesticide use.

Future Effects and Their Accumulation

Future effects to wildlife, and their accumulation, are discussed in the 2007 PEIS (USDOI BLM 2007a:4-212 to 4-213). Many of the causes of impacts to wildlife discussed in the preceding section will continue to have effects on wildlife. Loss, modification, and fragmentation of habitat will likely continue, increasing the likelihood of local extirpations of wildlife populations and loss of species diversity. Actions to protect sensitive species and their habitats, restore native plant communities and disturbance regimes, control the spread of invasive species, and reduce the risk of catastrophic wildfire are all expected to help offset some of the adverse impacts to wildlife and their habitats.

Use of herbicides and other pesticides will continue and likely increase, and wildlife will continue to be at risk for exposure to these chemicals. Identifying and restricting use of active ingredients with the greatest toxicological risks to wildlife in favor of active ingredients with lower risks would help reduce cumulative effects associated with exposure to pesticides.

Contribution of Alternatives to Cumulative Effects

Because the acreage of public lands treated with herbicides would be the same under all of the alternatives, the impacts to wildlife habitats would also be much the same under all the alternatives. Countervailing long-term effects associated with restoration of native plant communities and disturbance regimes would also be similar under all the alternatives.

Under the No Action Alternative, the number of herbicides used by the BLM with the potential to impact wildlife would be 18. Under Alternatives B and C, three additional herbicides would be used, and under Alternative D, two additional herbicides would be used. The potential toxicological effects to wildlife associated with the active ingredients vary. By allowing the BLM the flexibility to use additional herbicides, the action alternatives would result in the release of a larger number of active ingredients. As the three herbicides have a very low risk to wildlife, a cumulative effect of adding these active ingredients could be a reduction in overall risk to wildlife associated with herbicide use, as use of herbicides with a greater risk to wildlife would potentially be less.

It is expected that impacts associated with all of the herbicide active ingredients would be short-lived, as herbicides and their breakdown products would degrade over time. The ways in which aminopyralid, fluroxypyr, and rimsulfuron might interact with other active ingredients and the potential for synergistic effects are largely unknown. Additionally, the toxicity of breakdown products to wildlife is largely unknown.

Livestock

Past Effects and Their Accumulation

Past effects to livestock, and their accumulation, are discussed in the 2007 PEIS (USDOI BLM 2007a:4-222). They are predominantly associated with a decrease in the ability of public lands to support livestock grazing, which has occurred as a result of changes in fire regimes and the spread of noxious weeds. Past livestock grazing has contributed to these adverse effects, as have mineral extraction, recreation, and other activities.

Future Effects and Their Accumulation

Future effects to livestock, and their accumulation, are discussed in the 2007 PEIS (USDOI BLM 2007a:4-222 to 4-223). Many of the factors discussed in the preceding paragraph are ongoing and will continue to impact the quality of rangelands utilized by livestock. However, these effects will be minimized or offset by ongoing management programs designed to restore ecosystem processes and maintain livestock populations in balance with the health of rangelands. Treatments that control noxious rangeland weeds and reduce the risk of fire will also help to improve rangeland quality.

Contribution of Treatment Alternatives to Cumulative Effects

Because the acreage of public lands treated with herbicides would be the same under all of the alternatives, there would be no difference in the amount of rangeland targeted by herbicide treatments under any of the alternatives. Use of herbicides in rangelands could have some short-term adverse effects by removing large areas of vegetation and non-target species used by livestock as forage. However, over the long-term it would have countervailing effects of improving the quality of rangeland forage and controlling noxious weeds that are unpalatable or toxic to livestock.

Under the No Action Alternative, the number of herbicides used by the BLM with the potential to impact livestock would be 18. Under Alternatives B and C, three additional herbicides would be used, and under Alternative D, two additional herbicides would be used. The potential toxicological effects to livestock associated with herbicide active ingredients vary. However, the three new herbicides are not associated with toxicological risks to livestock, and their use may result in a reduction in the use of active ingredients with greater toxicological risks. Therefore, a cumulative effect of adding these active ingredients could be a reduction in overall risk to livestock associated with herbicide use.

Wild Horses and Burros

Past Effects and Their Accumulation

Past effects to wild horses and burros, and their accumulation, are discussed in the 2007 PEIS (USDOI BLM 2007a:4-223 to 4-225). They include a large reduction in the wild horse and burro populations in the 1930s and 1940s as a result of capture and removal, which was halted with the passage of the Wild Free-Roaming Horses and Burros Act of 1971. Since then, the BLM has attempted to maintain populations at levels that can be supported by the available resources, but populations continue to be well above that level. Activities that reduce the quantity or value of available resources have had an adverse effect on wild horses and burros. These include development, grazing, and building of fences and other structures that impede herd movements.

The maximum AML is currently 26,684, which is lower than it was when the 2007 PEIS was completed. However, the total number of wild horses and burros on public lands has increased since then to 49,209, which is over 22,500 animals more than public rangeland can sustain (USDOI BLM 2014a).

Future Effects and Their Accumulation

Future effects to wild horses and burros, and their accumulation, are discussed in the 2007 PEIS (USDOI BLM 2007a:4-225). The BLM will continue management efforts to keep wild horse and burro populations at AMLs in balance with the condition of rangelands, which will require continued removal and adoption of animals, as well as measures to control reproduction. Additionally, the factors discussed in the

preceding section will continue to impact the quality of rangelands and impede movement by wild horses and burros. Treatments that control noxious rangeland weeds and reduce the risk of fire will also help to improve rangeland quality and its ability to support wild horse and burro populations.

Contribution of Alternatives to Cumulative Effects

The acreage of rangelands treated with herbicides would be the same under all of the alternatives. Use of herbicides in rangelands could have some short-term adverse effects by removing large areas of vegetation and non-target species used by wild horses and burros as forage. However, over the long term it would have countervailing effects of improving the quality of rangeland forage and controlling noxious weeds that are unpalatable or toxic to wild horses and burros.

Under the No Action Alternative, the number of herbicides used by the BLM with the potential to impact wild horses and burros would be 18. Under Alternatives B and C, three additional herbicides would be used, and under Alternative D, two additional herbicides would be used. The potential toxicological effects to wild horses and burros associated with herbicide active ingredients vary. However, the three new herbicides are not associated with toxicological risks to large mammals, and their use may result in a reduced need for active ingredients with greater toxicological risks. Therefore, a cumulative effect of adding the three new active ingredients could be a reduction in overall risk to wild horses and burros associated with herbicide use.

Paleontological and Cultural Resources

Past Effects and Their Accumulation

Past effects to paleontological and cultural resources, and their accumulation, are discussed in the 2007 PEIS (USDOI BLM 2007a:4-223 to 4-225). Past exploration and development in the western U.S. has led to legal and illegal collection of paleontological resources and inadvertent damage. Many cultural resources have been lost or damaged by exposure to the elements or by collection or destruction of cultural sites. These losses are permanent, but have been slowed by legislation designed to protect these resources from damage and removal.

Future Effects and Their Accumulation

Future effects to paleontological and cultural resources, and their accumulation, are discussed in the 2007 PEIS (USDOI BLM 2007a:4-226 to 4-228). While the widespread loss and damage of paleontological and cultural resources has been slowed, ground-disturbing activities with the potential to disturb undiscovered resources continue to occur in the western U.S. These activities include resource extraction, livestock grazing, and motorized recreation, among others. Over time, additional buried resources may be exposed naturally through erosion, increasing their susceptibility to damage or collection. Additionally, wildfires and invasive species have altered native plant communities, and continue to displace native plants and animals that provide traditional lifeway values to native peoples.

Contribution of Alternatives to Cumulative Effects

Because the acreage of public lands treated with herbicides would be the same under all of the alternatives, there would be no difference in the geographic extent of public lands targeted by herbicide treatments under any of the alternatives. Therefore, risks for impacts to paleontological and cultural resources would also be the same. Countervailing effects associated with controlling invasive species and reducing the risk of catastrophic wildland fire, which would improve conditions for native plants and animals that provide traditional lifeway values, would also be similar under all the alternatives.

Under the No Action Alternative, the number of herbicides used by the BLM would be 18. Under Alternatives B and C, three additional herbicides would be used, and under Alternative D, two additional herbicides would be used. Adding new herbicides would increase the total number of active ingredients released into the environment. From a perspective of potential risks to Native Americans from exposure to herbicides, the three new herbicides have no to low risk to humans via various exposure scenarios. The potential for synergistic human health effects associated with mixtures of multiple ingredients is not known.

Visual Resources

Past Effects and Their Accumulation

Past effects to visual resources, and their accumulation, are discussed in the 2007 PEIS (USDOI BLM 2007a:4-229 to 4-230). Humans have altered the visual character of lands in the western U.S. through activities such as resource extraction, agriculture, road construction, urbanization and other development, timber harvesting, livestock grazing, introduction of exotic species, and exclusion of fire. As a result, landscapes have changed,

and are now marked by different vegetation composition, structure, and pattern.

Future Effects and Their Accumulation

Future effects to visual resources, and their accumulation, are discussed in the 2007 PEIS (USDOI BLM 2007a:4-225). The activities described in the preceding paragraph continue to influence the visual characteristics and scenic quality of landscapes. Ongoing vegetation management programs will alter the visual quality of public lands over the short term by removing vegetation, and in some cases creating large areas of open, browned, or blackened landscapes. However the BLM's long-term goals to restore degraded lands, reinstate properly functioning ecosystem processes, and restore degraded lands will likely help improve the visual character of public lands, particularly for VRM Class I and II lands with high scenic values. Other federal, state, tribal, and local agencies, and private conservation groups will also continue efforts to improve land health which will result in countervailing effects to visual resources.

Contribution of Alternatives to Cumulative Effects

Because the acreage of public lands treated with herbicides would be the same under all of the alternatives, impacts to visual resources would occur over the same geographic area under all alternatives. Additionally, the degree of the effects, and their contribution to cumulative effect, would be the same under all the alternatives. None of the alternatives would alter land uses on public lands, or introduce long-term changes that would be in conflict with the BLM's visual resource management goals. Over the long term, all of the alternatives would be expected to contribute positively to scenic qualities of public lands. Additionally, all of the alternatives would help reduce the risk of wildfire that has a visual impact on public lands and other scenic lands in the western U.S.

Wilderness and Other Special Areas

Past Effects and Their Accumulation

Past effects to wilderness and other special areas, and their accumulation, are discussed in the 2007 PEIS (USDOI BLM 2007a:4-229 to 4-231). While wilderness and other special areas continue to be protected from development by their status designations, these areas are threatened by factors that degrade their unique qualities. These factors include: 1) exotic and non-native species; 2) wildland fire suppression; 3) loss of water and deterioration in water quality; 4) fragmentation and isolation of wilderness as ecological islands; 5) loss of threatened and endangered species; 6) deterioration in air quality; 7) motorized and mechanical equipment trespass and use; 8) increasing commercial and public recreation use; 9) adjacent land uses; and 10) urbanization and encroachment. All of these factors continue to contribute to loss of wilderness values or other unique qualities.

Future Effects and Their Accumulation

Future effects to wilderness and other special areas, and their accumulation, are discussed in the 2007 PEIS (USDOI BLM 2007a:4-231 to 4-232). The threats described in the previous paragraph are ongoing, and will continue to impact the unique qualities of wilderness and other special areas. Additionally, with increases in population these areas may be further degraded through overuse. Additionally, pressure to utilize protected areas for resource extraction may result in future loss or degradation of these areas. Vegetation treatment programs in and near these areas that aim to control the spread of noxious weeds and restore natural fire regimes, if successful, will help reduce some of the threats to wilderness and other special areas, but not others. Actions by conservation groups and other entities to protect these areas may also help offset or slow some of the factors that degrade the unique qualities of wilderness and other special areas.

Contribution of Alternatives to Cumulative Effects

Because the acreage of public lands treated with herbicides, as well as the areas targeted for treatments, would be the same under all of the alternatives, the impacts to wilderness and other special areas would be the same under all the alternatives. Adverse effects to these areas would generally be short-term effects associated with site closures and disturbances during herbicide treatments. Therefore, they would not be expected to contribute to long-term adverse effects. Countervailing effects associated with slowing future degradation of these areas or improving them through control of invasive species and restoration of native habitats and disturbance regimes would also be the same under all the alternatives.

The number of herbicides used, which would vary to some degree under the alternatives, would not be expected to have a substantial difference in how the action contributes to cumulative effects. The BLM would be able to control target species and reduce

wildfire risk under all alternatives, although there would be a few additional options under the action alternatives.

Under the No Action Alternative, the number of herbicides used by the BLM with the potential to impact wildlife would be 18. Under Alternatives B and C, three additional herbicides would be used, and under Alternative D, two additional herbicides would be used. The use of new active ingredients could introduce new chemicals to areas that are relatively undisturbed. Although the new active ingredients have low risk to fish, wildlife, and other resources, the cumulative increase in pesticide use in wilderness and other special areas could have a negative connotation from a public opinion perspective.

Recreation

Past Effects and Their Accumulation

Past effects to recreation, and their accumulation, are discussed in the 2007 PEIS (USDOI BLM 2007a:4-223 to 4-233). Recreation opportunities on public lands have increased with the creation of recreational facilities and development of numerous recreation programs. These programs provide opportunities for outdoor recreation for millions of visitors annually. Other uses on BLM lands, such as livestock grazing, timber harvesting, and oil and gas activities, have limited recreation opportunities in certain locations. Additionally, the spread of invasive plants and wildfires have adversely affected recreation opportunities.

Future Effects and Their Accumulation

Future effects to visual resources, and their accumulation, are discussed in the 2007 PEIS (USDOI BLM 2007a:4-233 to 4-234). With the growth of the population in the West and a continued interest in recreation, the amount of use that BLM lands receive by the public will likely continue to increase. At the same time, the BLM will not be able to substantially expand its recreational opportunities. Therefore, existing lands and recreational facilities will be used more intensively, potentially reducing the recreation experience in certain areas and resulting in degradation of recreational facilities. Recreational visitors likely contribute to the spread of invasive species on public lands. Additionally, development and other activities in areas near public lands could lessen recreational experiences if they are visible from public lands.

Vegetation treatments programs by the BLM have a goal of restoring native plant communities, improving wildlife habitat quality, controlling the spread of invasive species, and reducing wildfire risk, and would help to offset some of the impacts caused by recreationists, as well as improve the quality of recreational opportunities on public lands.

Contribution of Alternatives to Cumulative Effects

Because the acreage of public lands treated with herbicides would be the same under all of the alternatives, impacts to recreation would occur over the same geographic area under all alternatives. Additionally, the degree of the effects, and their contribution to cumulative effect, would be similar under all the alternatives. Adverse effects associated with herbicide treatments would be short term in duration, and would be unlikely to contribute to long-term adverse effects to recreation. Beneficial effects associated with control of invasive species, reduction of wildfire risk, and restoration of native plant communities would be similar under all of the alternatives.

Under the No Action Alternative, the number of herbicides used by the BLM would be 18. Under Alternatives B and C, three additional herbicides would be used, and under Alternative D, two additional herbicides would be used. Under all alternatives, herbicides would be available that would allow the BLM to meet its treatment goals, including control of invasive species at visitor centers and other recreational facilities, restoration of native communities, and protection of recreation sites from risks associated with wildfire. The action alternatives would allow the BLM additional options for treating invasive species that could improve the effectiveness of treatment programs in certain circumstances. Additionally, aminopyralid and fluroxypyr would be mixed with other active ingredients to improve their effectiveness against certain target plants, and may help address resistance management issues at sites where invasive species are controlled repeatedly.

Social and Economic Values

Past Effects and Their Accumulation

Past effects to social and economic values, and their accumulation, are discussed in the 2007 PEIS (USDOI BLM 2007a:4-235 to 4-236). Social and economic factors that are important from the perspective of public lands include the continued population growth in the western U.S., environmental justice concerns associated with communities with high densities of Native

Americans and other minority populations, the importance of jobs and industries associated with natural resources and resource extraction, increasing wildfire risks and associated risks to private property, and economic benefits from activities conducted on BLM lands, such as grazing, harvest of timber and other forest products, and oil and gas development.

Between 2000 and 2010, population growth in the western U.S. was 13.8 percent (U.S. Department of Commerce Bureau of the Census 2011).

Industries related to natural resources, such as agriculture and mining, are important sources of employment and represent nearly half of the nation's agricultural services, forestry, and fishing jobs.

Future Effects and Their Accumulation

Future effects to social and economic values, and their accumulation, are discussed in the 2007 PEIS (USDOI BLM 2007a:4-236 to 4-238).

It is expected that all populations in the western U.S. will continue to increase, and that use of BLM-administered lands by the public will also continue to increase. Population growth is cumulative, and actions on public lands and elsewhere will continue to affect greater numbers of people, including larger minority and low income populations. BLM lands will continue to provide a source of land for the federal government and local economies, with a possible low-level increase in those benefits through activities to improve the condition of rangelands and other public lands. Oil and gas and mineral resource extraction on public lands are expected to continue to be important sources of income into the future. Recreation is also likely to continue to be an important source of income, with vegetation treatments that improve the quality of public lands for recreation likely to benefit recreational opportunities.

It is expected that expenditures by the BLM will continue to range from about $1 billion to $1.15 billion, with budgets fluctuating from year to year. It is also expected that the BLM will continue to generate more revenue for the federal government than it spends. Oil and gas resources will likely continue to be the primary source of revenue, with timber sales, grazing, and recreation also important, although to a much lesser degree.

With population increases in the western U.S., it is expected that effects to private property from activities on public lands will be an increasing concern. However, efforts by the BLM, Forest Service, and other agencies to reduce wildfire risk may have an overall benefit to private property over the long term if incidence and severity of wildfire is reduced, particularly in the WUI.

Contribution of Alternatives to Cumulative Effects

All of the alternatives would reduce the costs of herbicide treatments, although it is expected that there would be no difference in the BLM's overall expenditures on vegetation treatments. Under Alternative B, the cost reduction could be between 1 and 2 percent, whereas the reduction would be less than 1 percent under Alternative B, and a fraction of 1 percent under Alternative D. Annual vegetation treatments costs, assuming all methods, would be the same under all the alternatives, amounting to an estimated $1.4 billion. Under all alternatives, short-term adverse impacts in terms of costs and long-term improvements in terms of resource benefits would be similar, although the cost to obtain the same degree of benefit could be slightly higher under Alternatives B and C because of lower herbicide costs. Under all alternatives, the contribution of treatment actions to the economy of the western U.S. would continue to be minor.

Human Health and Safety

Past Effects and Their Accumulation

Past effects to human health and safety, and their accumulation, are discussed in the 2007 PEIS (USDOI BLM 2007a:4-238 to 4-241). In terms of occupational risks, workers in the western U.S., including workers on public lands, have been exposed to risks associated with use of power tools, vehicles, loud noises, and other risk factors. Certain occupations may expose workers to chemicals (including pesticides) and other substances that can lead to cancer and other health conditions. Job-related fatalities and injuries continue to be reported in the western states. The public is also exposed to various chemicals and environmental pollutants, and may be at risk for injury or death as a result of fire, particularly in the WUI.

Future Effects and Their Accumulation

Future effects to human health, and their accumulation, are discussed in the 2007 PEIS (USDOI BLM 2007a:4-212 to 4-213). Many of the health and safety concerns discussed in the preceding paragraph will continue to be concerns in the future. Many occupations will continue to be associated with some level of risk, particularly

when vehicles and machinery are operated, and when workers are exposed to potentially hazardous chemicals. Firefighters will continue to be exposed to high levels of risk. However, implementation of employer health and safety programs and associated steps to reduce risk will continue to help protect worker health and safety. BLM pesticide operators and other workers will continue to transport and handle ingredients that pose a toxicological risk to humans, although these risks will continue to be minimized through SOPs and use of appropriate PPE.

The public will continue to be exposed to various pollutants; the cumulative effects of these exposures could include development of cancer and health conditions. Risks associated with wildfire, such as smoke inhalation risks and potential for loss of life, could increase if large, difficult to control wildfires continue to increase in frequency and size. Treatment programs by the BLM and other agencies to take aggressive actions to reduce catastrophic fire risk may continue to offset some of the wildfire risk in targeted areas, such as the WUI where the most people are likely to be affected.

Contribution of Alternatives to Cumulative Effects

Under all of the alternatives, the same acreage would be treated with herbicides annually, with the same treatment goals, so the geographic extent of adverse and beneficial effects associated with herbicide use would also be the same. Under all of the alternatives, herbicides with some risk to human health would be applied in the same areas on public lands, although the number of herbicides used and the amounts of usage would vary among the alternatives. Under the action alternatives, two or three new active ingredients would be used, in addition to currently approved herbicides, resulting in a cumulative increase in the number of ingredients used on public lands. The new herbicides have no to very low risk to human health via various exposure scenarios. The potential for synergistic human health effects associated with mixtures of multiple ingredients is not known.

Benefits to human health from herbicide treatments would be similar under all the alternatives. Treatments would help reduce wildfire risk and associated risks to human health. Over the long term, restoration of natural fire regimes and improvement in ecosystem health should reduce risks to human health from activities originating on public lands and affecting public land users or those living near public lands.

Unavoidable Adverse Effects

The 2007 PEIS summarizes the unavoidable adverse effects that would occur as a result of the BLM's vegetation management programs, including herbicide treatments with the 18 currently approved herbicides and other forms of vegetation treatment analyzed in the 2007 PER (USDOI BLM 2007a:4-243 to 4-246).

As the three new herbicides would be incorporated into the BLM's treatment programs, but the extent and goals of those programs would remain unchanged, the analysis provided in the 2007 PEIS is largely applicable to treatments involving aminopyralid, fluroxypyr, and rimsulfuron. This information is summarized here.

Air Quality

Herbicide treatments would continue to result in the release of air quality pollutants, including GHGs. No new air emissions would occur as a result of adding the three new herbicides.

Soil Resources

Herbicide treatments would continue to result in increased erosion over the short-term, and potentially loss of soil and soil function and productivity. No additional impacts to soil would occur as a result of adding the three new herbicides, although soil resources would be exposed to new active ingredients and their degradation products.

Water Resources and Quality

Herbicide treatments would continue to result in soil erosion and surface water runoff from removal of vegetation, and impacts to surface water and groundwater quality. The geographic extent of water resources potentially exposed to herbicide treatments would not increase as a result of adding the three new herbicides, but new active ingredients, degradates, and other ingredients would be released to the environment, increasing the number of potential water contaminants.

Wetland and Riparian Areas

Herbicide treatments in wetlands and riparian areas would continue to increase soil erosion and surface water runoff, potentially leading to streambank erosion and sedimentation into wetlands and riparian areas. Removal of vegetation could also alter wetland hydrology and function. The extent of these impacts

would not increase from current levels as a result of adding the three new herbicides.

Vegetation

Herbicide treatments would continue to cause unavoidable short-term disturbances to plant communities by killing both target and non-target plants. The extent of these impacts is not expected to increase as a result of adding the three new herbicides, as they act by modes of action similar to those of some of the currently approved active ingredients.

Fish and Other Aquatic Organisms

Removal or alteration of vegetation in and near aquatic habitats would continue to affect fish and other aquatic organisms through release of sediments into habitats, or by changing other habitat characteristics (such as amount of shading). With the addition of the three new herbicides, the extent of these impacts would remain the same as at present.

Wildlife Resources

Some wildlife would be exposed to herbicides as a result of treatments and could suffer toxicological effects. Adding the three new herbicides would not increase these effects to wildlife, and could potentially decrease them, as the three new herbicides are of low risk to wildlife. Herbicide treatments would also continue to alter wildlife habitats, and could cause unavoidable short-term adverse effects to wildlife habitat and behavior. With the addition of the three new herbicides, the extent of these impacts would remain the same as at present.

Livestock

Herbicide treatments would continue to temporarily affect livestock by removing non-target vegetation used as forage or for other needs. Some exposure of livestock to herbicides could also occur, potentially resulting in toxicological effects. The three new herbicides do not pose a risk to livestock, and would not increase impacts to vegetation used by livestock over current levels.

Wild Horses and Burros

Herbicide treatments would continue to have the potential to impact wild horses and burros by removing non-target vegetation used as forage or for other needs. Some exposure of livestock to herbicides could also occur, potentially resulting in toxicological effects. The three new herbicides do not pose a risk to wild horses and burros, and would not increase impacts to vegetation used by these animals over current levels.

Paleontological and Cultural Resources

Paleontological Resources

Herbicide treatments would continue to have the potential to affect fossil resources through exposure of these resources or potential chemical alterations associated with active or other ingredients in herbicide formulations. The action to add three new herbicides would not increase the likelihood of risk to these resources unless one of the active ingredients is particularly damaging to fossil resources. Use of SOPs would reduce the likelihood of impacts to paleontological resources.

Cultural Resources and Traditional Lifeway Values

Herbicide treatments would continue to have the potential to affect cultural resources, primarily through chemical alterations of cultural materials associated with active or other ingredients in herbicide formulations. Use of herbicides would continue to have the risk of impacting non-target plant species of cultural importance to Native groups. Herbicide treatments could also discourage or prohibit Native peoples from using these areas, or potentially harm Native peoples harvesting plant materials or conducting other activities in treated areas. However, the addition of three new active ingredients would not increase these unavoidable risks or impacts beyond current levels.

Visual Resources

Herbicide treatments would not result in unavoidable adverse effects to visual resources over the long term, but over the short term they could adversely affect the visual character of the treated areas. Adding the three new herbicides would not increase the extent or degree of effects to visual resources.

Wilderness and Other Special Areas

Herbicide treatments would continue to affect wilderness and other special areas through removal of vegetation, alteration of plant communities, and through human presence in wilderness areas. Adding the three new herbicides would not change the extent or degree of these effects.

Recreation

Unavoidable adverse effects to recreation from herbicide treatments would continue to include scenic degradation and noise associated with treatments, alteration of resources, and the temporary closure of certain areas to recreation. Adding the three new herbicides would not change the extent or degree of these effects.

Social and Economic Values

Short-term closures or restrictions on public lands, such as implementation of herbicide use re-entry restrictions to protect public health or to restrict access by grazing animals for the time period specified on the herbicide label until seeding efforts are established (up to two growing seasons), would continue to be unavoidable. Communities that are particularly dependent on a single industry would continue to be the most susceptible to adverse effects to employment or income due to vegetation treatment projects. In particular, ranching communities and recreation-dependent communities may be more affected than communities with diversified industries.

Limits on grazing activity on public lands could continue to put additional pressure on often tight economic margins in ranching. Closures of treatment areas for extended periods of time could temporarily affect some recreational uses and commercial activities.

Human Health and Safety

Herbicide treatments would continue to have the risk of harming workers or the public, primarily through accidental exposures to herbicides. Although workers would follow all SOPs to reduce risks, not all risks could be avoided. The addition of three new active ingredients would not increase the degree of risks to human health and safety. The three new active ingredients have no to low risks to humans.

Relationship between the Local Short-term Uses and Maintenance and Enhancement of Long-term Productivity

This section discusses the short-term effects of herbicide treatment activities, versus the maintenance and enhancement of potential long-term productivity of public land environmental and social resources. The 2007 PEIS summarized this information for the BLM's ongoing vegetation management programs (USDOI BLM 2007a:4-246 to 4-251).

As the three new herbicides would be incorporated into the BLM's vegetation management programs, but the extent and goals of those programs would remain unchanged, the analysis provided in the 2007 PEIS is largely applicable to treatments involving aminopyralid, fluroxypyr, and rimsulfuron. This information is summarized here.

In all cases, short-term refers to the total duration of vegetation treatment activities (10 to 15 years) and long-term refers to an indefinite period of time.

Air Quality

Herbicide treatments would have a small short-term impact on air quality, predominantly associated with use of vehicles during applications. Much of the focus of treatments is on reducing hazardous fuels, restoring natural fire regimes and reducing the occurrence of large, unwanted wildfires. Thus, the proposed vegetation treatments should reduce smoke emissions associated with public lands over the long term. While individual herbicide treatment projects would have GHG emissions, repeated herbicide treatments and post-treatment reseeding/restoration may reduce the risk of wildfire, leading to fewer GHG emissions in the long term.

Soil Resources

Although treatments would have short-term effects on soil condition and productivity, it is predicted that the soil disturbance associated with restoration activities would have less impact and be less severe than soil erosion caused by wildfire and encroachment by invasive species and noxious weeds. Furthermore, monitoring and evaluation, integrated with an adaptive management approach, would allow the BLM to adjust treatments to reduce soil disturbance to levels similar to historical conditions.

Restoration activities that move forests and rangelands toward historical ranges of variability would provide favorable conditions for soil functions and processes, and contribute to long-term soil productivity levels at the broad scale (USDA Forest Service and USDOI BLM 2000).

Water Resources and Quality

Herbicide treatments would result in short-term impacts to water quality through movement of active and other ingredients into the water and through erosion and surface water runoff from treatment sites. Successful control of invasive plants, however, would lead to improved conditions in watersheds over the long term, with the greatest improvement likely to occur in degraded watersheds. Additionally, treatments that reduce hazardous fuels would benefit ecosystems by reducing the chances of a large, unwanted wildfire, which could result in the destruction of a large amount of high quality habitat, potentially leading to erosion, especially if followed by heavy rainfall. Hazardous fuels reduction would also decrease the likelihood that wildfire suppression activities would occur in or near aquatic habitats.

Wetland and Riparian Areas

Removal of vegetation could cause a short-term increase in soil erosion and surface water runoff and could impact wetland and riparian areas. Additionally, there could be some release of active and other ingredients into wetland and riparian areas. Successful control of invasive plants in wetlands and riparian areas, however, would lead to improved conditions in these habitats over the long term. The eventual growth of desirable vegetation in treated areas would moderate water temperatures, buffer the input of sediment and herbicides from runoff, and promote bank stability in riparian areas.

Vegetation

Herbicide treatments would remove vegetation from treatment sites over the short term, and could impact non-target desirable vegetation. However, treatments that remove or control invasive vegetation would benefit non-target species by providing increased access to water and nutrients and enhanced vigor from reduced competition with invasive species. Over the long term, target sites should have an increased component of native species. Additionally, control of cheatgrass and other fire adapted species would benefit the long-term health of plant communities in which natural fire cycles have been altered. Over the long term, treatments should also reduce the occurrence of large, unwanted wildfires across the western U.S.

Fish and Other Aquatic Organisms

Herbicide treatments could have short-term adverse impacts to fish and other aquatic organisms through release or movement of active and other ingredients into aquatic habitats. These impacts would be minimized through the use of buffers. The three new herbicides are of low risk to aquatic species. Over the long term, control of noxious weeds in riparian habitats, reduction of wildfire risk through hazardous fuels reduction, and other efforts to improve the quality of watersheds would have beneficial effects on fish and other aquatic organisms. Benefits would include improved habitat quality, improved hydrologic functions, and reduced soil erosion.

Wildlife Resources

All treatments could have short-term adverse impacts to wildlife and their habitats, as discussed under Unavoidable Adverse Effects above. The three new herbicides are of lower risk to wildlife than many of the currently approved herbicides. Treatments that improve habitat would provide long-term benefits to wildlife by restoring wildlife habitat and reducing the risk of catastrophic wildfire. Habitat improvements would likely be slow, occurring over multiple decades.

Livestock

The proposed vegetation treatments would affect the availability and palatability of livestock forage over the short term. These impacts would begin to disappear within one to two growing seasons after treatment. Over the long-term, the quality of forage should improve, as noxious weeds that are unpalatable or toxic to wildlife would be controlled. Additionally, reduction in the risk of future catastrophic wildfire would benefit livestock by preventing the temporary loss of large blocks of rangeland to fire, and reducing the prevalence of fire-adapted species.

Wild Horses and Burros

The proposed vegetation treatments would affect the availability and palatability of vegetation over the short term. These impacts would begin to disappear within one to two growing seasons after treatment. Over the long-term, the quality of forage should improve, as noxious weeds that are unpalatable or toxic to wild horses and burros would be controlled. Additionally,

reduction in the risk of future catastrophic wildfire would benefit wild horses and burros by preventing the temporary loss of large blocks of habitat that would displace wild horses and burros and potentially reduce the AML.

Paleontological and Cultural Resources

Paleontological Resources

Because paleontological resources are nonrenewable, there is no difference between short-term and long-term impacts. These resources cannot recover from some types of adverse impacts. Once disturbed, the materials and information of paleontological deposits may be permanently compromised. Chemical alterations to fossil materials would likely be permanent. Any destruction of paleontological sites, especially those determined to have particular scientific value, would represent long-term losses. Furthermore, once paleontological deposits are disturbed and exposed, natural erosion could accelerate the destruction of fossils, and exposed fossils would be vulnerable to unauthorized collecting and digging. Any discoveries of paleontological resources as a result of surveys required prior to treatment would enhance long-term knowledge of the area and these resources.

Cultural Resources and Traditional Lifeway Values

Any destruction of cultural resource sites would represent long-term losses. Chemical alterations to historic materials would likely be permanent. Archaeological excavation to recover scientific data under the terms of an appropriate data recovery plan could result in the partial or total destruction of the site, although the recovered data would effectively mitigate for this destruction. Any investigations of cultural resources made during inventories or investigations required prior to herbicide treatments would enhance knowledge of the history and early inhabitants of the region and serve to effectively mitigate further potential effects of activities in the area.

Herbicide treatments could have short-term impacts on traditional lifeway values by temporarily restricting access to traditional use sites, and by impacting non-target vegetation of cultural importance. Herbicide treatments could also temporarily displace wildlife used for subsistence. However, long-term restoration of native plant communities and natural ecosystem processes to the benefit of traditional lifeway resources should compensate for the short-term losses in use.

Visual Resources

Vegetation treatments would continue to affect visual resources by changing the scenic quality of the landscape. Over the short-term, impacts to visual resources from herbicide treatments would begin to disappear within one to two growing seasons. The regrowth of vegetation on the site would eliminate much of the stark appearance of treated areas, and the site would develop a more natural appearance.

Over the long term, vegetation treatments would likely improve visual resources on public lands. Treatments that aim to rehabilitate degraded ecosystems, if successful, would result in plant communities dominated by native species (see the Vegetation section for more information). Native-dominated communities tend to be more visually appealing and productive than areas that have been overtaken by weeds (e.g., areas supporting a cheatgrass monoculture).

Wilderness and Other Special Areas

Impacts to wilderness and other special areas would begin to disappear within one to two growing seasons after herbicide treatments. The regrowth of vegetation on the site would eliminate much of the stark appearance of treated areas, and the site would develop a more natural appearance. Benefits to plants and animals in terms of ecosystem function and improved forage and cover would occur as the treated area recovered.

Over the long term, vegetation treatments would likely improve resources on wilderness and other special areas. Treatments that successfully rehabilitate degraded ecosystems would result in plant communities that are dominated by native species (see the Vegetation section for more information). Native-dominated communities often provide better habitat for fish and wildlife, including species of concern that communities with a large component of non-native species.

Recreation

There would be some scenic degradation, as well as distractions to users (e.g., noise from vehicles), from treatments. In addition, there would be some human health risks to recreationists associated with exposure to herbicides, which would be minimized through use of SOPs. Finally, some areas would be off-limits to recreation activities as a result of treatments. These effects would be localized and short term.

Treatments that restore native vegetation and natural fire regimes and other ecosystem processes would provide a long-term benefit to recreationists. Treatments would improve the aesthetic and visual qualities of recreation areas, reduce the risk of recreationists coming into contact with noxious weeds and poisonous plants, increase the abundance and quality of plants harvested from public lands, and improve habitat for fish and wildlife sought by fishermen and hunters.

Social and Economic Values

Over the short term, restrictions on the use of treated lands could cause social and economic hardship to affected parties. However, individuals and industries involved in the restoration of native ecosystems on public lands would benefit.

Over the long term, most users of public lands, and those with interests near public lands, would likely benefit. An important goal of treatments is to restore ecosystem health so that public lands can provide sustainable and predictable products and services. In addition, treatments would reduce risks to communities associated with large-scale wildfire, improve ecosystem health to the benefit of recreationists and other public land users, and emphasize employment- and income-producing management activities near those communities most in need of economic support and stimulus. The enhancement in long-term productivity of public lands to provide for social and economic needs would reflect not only the success or failure of treatments, but also the influence of outside forces (e.g., economy, lifestyle changes, and climate) over which the BLM and other federal agencies have no control (USDA Forest Service and USDOI BLM 2000).

Human Health and Safety

Herbicide treatments could harm the health of workers and the public over the short term, although SOPs would minimize these risks. The three new herbicides have no to low health risks under most exposure scenarios. Adverse reactions to herbicides could cause minor to severe discomfort to sensitive individuals, but most symptoms would go away in a few hours. If serious injury or death were to result from treatments (most likely to occur as a result of vehicle operation), the effects to the health of the affected individual would be long term, or in the case of death, permanent.

All treatments that successfully reduce the cover of noxious weeds and restore native vegetation would help to restore natural fire regimes and improve ecosystem health, which would in turn provide a benefit to human health. A reduced risk of wildfire would reduce the risk of injury, death, and other health risks associated with fire. Additionally, herbicide treatments would slow the spread of poisonous and other noxious weeds that are harmful or annoying to humans.

Irreversible and Irretrievable Commitment of Resources

This section identifies irreversible and irretrievable commitments of resources that would occur from herbicide treatments. Irreversible and irretrievable commitments of resources refer to impacts or losses to resources that cannot be reversed or recovered. Examples are the extinction of a species or the permanent conversion of a vegetated wetland to open water. In the first case, the loss is permanent and not reversible under current genetic technology. In the second case, it is possible the open water could be drained, so while the initial loss of the vegetated wetland is irretrievable, the action could be reversible.

Since aminopyralid, fluroxypyr, and rimsulfuron would be utilized in existing treatment programs and are generally of low risk to resources, their addition to the list of approved active ingredients would not result in additional irreversible or irretrievable commitments of resources above what was discussed in the 2007 PEIS (USDOI BLM 2007a:4-251 to 4-253). Commitments pertaining to herbicide treatments from this earlier document are summarized here.

Air Quality

Air quality would be affected by emissions from vehicles used during herbicide applications. These effects would occur only during the period of the treatment activity and there would be no irreversible or irretrievable effects on air quality.

Soil Resources

Herbicides could impact soil biota and productivity, although it is unclear to what degree these effects would be irreversible or irretrievable. It is expected that soil functions would eventually return with the establishment of native vegetation and a reduced risk of wildfire.

Water Resources and Quality

An accidental herbicide spill could cause damage to water bodies lasting for several months. The ability to

use water resources in the affected area could be lost for an unknown period of time. In many cases, these impacts could be reversed over time through degradation of the active and other ingredients and their degradates. In other cases, irreversible or irretrievable commitments of water resources could occur.

Wetland and Riparian Areas

Although there would be short-term impacts to these resources from herbicide treatments, these impacts generally would not be irretrievable and would be reversed with degradation of the herbicides and if restoration treatments were successful. Under certain circumstances, irreversible or irretrievable commitments of wetland or riparian resources could occur.

Vegetation

Native vegetation and plant productivity that is lost as a result of treatments would be irretrievable only until vegetation is reestablished, usually within several growing seasons. With the use of appropriate buffers to protect populations, irreversible and irretrievable loss of special status plants would not occur.

Fish and Other Aquatic Organisms

Some fish and other aquatic organisms would be at risk for adverse toxicological effects from herbicide treatments, particularly under accidental spill scenarios, although the three new herbicides are of low toxicity to aquatic organisms. Buffer zones to protect aquatic species would minimize these risks. While some individual organisms could be affected irreversibly, overall effects to populations would be reversible. Additionally, populations would benefit from treatments that improve riparian and aquatic habitats.

Wildlife Resources

Native wildlife and habitat productivity that is lost as a result of treatments would be irretrievable until native plant communities are reestablished, usually within several growing seasons. Treatments that improve rangeland and forestland ecosystem health, including plant productivity, would translate into benefits for wildlife, except for those species that have adapted to or thrive in areas where vegetation has changed from historic conditions.

Livestock

Short-term loss in vegetation function and quality from treatments would have a short-term impact on livestock productivity. Although some livestock could be displaced from public lands, forage could be found elsewhere, although possibly at a higher cost. As rangelands improve as a result of treatments, their ability to support livestock use levels at or near current levels should also improve. Herbicide treatments have the potential to cause toxicological impacts to livestock, although the three new herbicides are of low toxicity to large grazing mammals. Any impacts to the livestock operation and industry would be reversible.

Wild Horses and Burros

Short-term loss in vegetation function and quality as a result of herbicide treatments would have a short-term impact on wild horse and burro productivity. Wild horses and burros could be removed from rangelands to reduce their impacts to rangeland health and to speed up the process of rangeland restoration. These animals would be placed into adoption or long-term pastures, or sold. As rangelands improve, their ability to support populations of wild horses and burros near current levels would also improve.

Herbicide treatments have the potential to cause toxicological impacts to wild horses and burros, although the three new herbicides are of low toxicity to large grazing mammals. Any associated impacts to wild horse and burro populations would be reversible.

Paleontological and Cultural Resources

Paleontological Resources

Because paleontological resources are nonrenewable, any impacts would render the resource disturbance irreversible and the integrity of the resource irretrievable.

Cultural Resources and Traditional Lifeway Values

Cultural resources are nonrenewable, so any impacts would be irreversible, and the integrity of the affected resource would be irretrievable. Any chemical changes to cultural materials associated with herbicide exposure would potentially be permanent. Archaeological

excavation to recover scientific data under terms of an appropriate data recovery plan could result in the partial or total destruction of the site, although the recovered data would effectively mitigate for this destruction. Any investigations of cultural resources made during inventories or investigations required prior to vegetation treatments would enhance knowledge of the history and early inhabitants of the region and serve to effectively mitigate further potential effects of activities in the area. Overall, such finds could help fill gaps in our knowledge of the history and early inhabitants of the area.

Vegetation treatment activities would impact plants and animals of traditional importance to Native peoples. However, these effects should be short-term and reversible, as native plant communities would recover and habitat for fish and game species would improve.

Visual Resources

There would be no irreversible or irretrievable commitment of visual resources. Although there would be short-term impacts to visual resources from vegetation treatments, loss of visual resources would not be irretrievable and could be reversed if restoration treatments are successful.

Wilderness and Other Special Areas

There would be no irreversible or irretrievable commitment of resources. Although there would be short-term impacts to wilderness and special area resources from vegetation treatments, these impacts would not be irretrievable and could be reversed if restoration treatments are successful.

Recreation

There would be no irreversible or irretrievable commitment of recreation resources. Although there would be short-term impacts to recreation resources from vegetation treatments, these impacts would not be irretrievable and could be reversed if restoration treatments are successful.

Social and Economic Values

Herbicide treatments would continue to involve a substantial commitment by the BLM in terms of labor and financial resources. Herbicide treatments associated with restoration activities would continue to provide temporary jobs in the western U.S. Once financial resources are used, they cannot be retrieved. Treatments that result in the closure of recreation or grazing areas could have an irretrievable impact on the income of those involved in these industries.

Human Health and Safety

Serious injury or death to humans caused by herbicide treatments could be irreversible and irretrievable. Risk of death or serious injury is very low, based on low numbers of past incidents, but accidents do occur. It is possible that humans would experience minor discomfort from herbicide treatments, but provided appropriate safety SOPs are implemented, these effects would be short term and reversible.

Energy Requirements and Conservation Potential

Herbicide formulations may contain petroleum products, and all herbicide treatment methods require the use of energy, to operate equipment to treat vegetation and to transport workers to and from the job site. Less energy would be used to conduct aerial treatments than ground treatments for each acre treated. Because all of the alternatives treat the same land area using herbicides, energy use for all, including the No Action Alternative, would be similar.

Natural or Depletable Resource Requirements and Conservation

Herbicide formulations may contain natural or depletable resources as constituents of the herbicide products or as carriers. It is anticipated that the use of natural and depletable resources would be minimal, and would be roughly the same under all of the alternatives, as the acreage treated would be the same. All herbicide treatment methods require the use of energy, as described in the preceding section.

CHAPTER 5

CONSULTATION AND COORDINATION

CHAPTER 5

CONSULTATION AND COORDINATION

Preview of this Section

This section summarizes the public involvement and scoping and public comment process conducted for the preparation of the Draft PEIS and Biological Assessment. Summaries of agency and Government-to-government consultation are provided. The individual preparers, with their areas of expertise and/or responsibility, are also listed.

Public Involvement

Federal Register Notices and Newspaper Advertisements

The BLM published a Federal Register Notice of Intent (Notice) on December 21, 2012 (Federal Register, Volume 77, Number 246, Pages 75648-75649). The BLM also released a press release concurrent with the Notice. The Notice asked the public to provide comments on the proposal to use aminopyralid, fluroxypyr, and rimsulfuron in its vegetation treatment activities, and to identify issues that should be considered in the PEIS. The Notice provided the locations and dates of the public scoping meetings, and stated that public comments on the proposal would be accepted until the close of the scoping period, or 15 days after the last public meeting, whichever was later. The press release indicated that the public comment period for the scoping process was 60 days.

Public notices of the scoping period and public meetings were placed in newspapers serving areas in or near locations where the meetings were held.

Scoping Meetings

Three scoping meetings were held within the geographic area covered by the project. One meeting was held in Worland, Wyoming (January 7, 2013), one was held in Reno, Nevada (January 9) and one was held in Albuquerque, New Mexico (January 10). The scoping meetings were conducted in an open-house style. Informational displays were provided at the meetings, and handouts describing the project, the NEPA process, and issues and alternatives were given to the public. A formal presentation provided the public with additional information on program goals and objectives. At each meeting, the presentation was followed by a question and answer session.

The BLM received 26 requests to be placed on the project mailing list from individuals, organizations, and government agencies, and 43 written comment letters or facsimiles on the proposal. In addition, to written comments received at the scoping meetings, four individuals provided oral comments. As most of the comment letters provided multiple comments, a total of 225 individual comments were catalogued and received during the public scoping period.

A *Scoping Summary Report for Vegetation Treatments Using Aminopyralid, Fluroxypyr, and Rimsulfuron on Bureau of Management Lands in 17 Western States Programmatic EIS* (AECOM 2013) was prepared that summarized the issues and alternatives identified during scoping.

Frequently Asked Questions

The BLM posted a list of frequently asked questions (FAQs) to the project website, with handouts of the same information provided at the public meetings. The FAQ handout discussed the BLM's proposed project, including where the proposed activities would occur. The handout also discussed the PEIS development process and potential issues to be examined in the PEIS, and detailed the public comment opportunities and instructions.

Agency Coordination and Consultation

Endangered Species Act Section 7 Consultation

The BLM initiated informal consultation with USFWS and NMFS (the Services) in February 2014. A Biological Assessment evaluating the likely impacts to listed species (and species proposed for listing) and critical habitats from the proposed action, and presenting programmatic level conservation measures to minimize impacts to these species, was submitted to the Services for their review and comment. An Essential Fish Habitat Assessment, as required under the Magnuson-Stevens Fishery Management Act, was submitted as an appendix to the Biological Assessment.

After receipt and review of the Biological Assessment, the BLM and the Services held several meetings to discuss the document and to respond to information requests from the Services. Meetings/conference calls were held on May 28, June 12, June 23, July 30, August 20, September 3, November 6, 2014, and January 9, 2015. The Services provided comments on the Biological Assessment in July 2014, and subsequent discussions provided resolutions to issues that were raised in the review comments.

Consultation with the Services pursuant to the ESA and Magnuson-Stevens Fishery Management Act is ongoing and will be completed by the time of the signing of the Record of Decision for this PEIS.

Risk Assessment Coordination

Ecological and human health risk assessments prepared for aminopyralid, fluroxypyr, and rimsulfuron were prepared in accordance with the protocols that were developed for risk assessments prepared for the 2007 PEIS. In 2002, The BLM convened a group of scientists from the USEPA, USFWS, NMFS, BLM, and its contractor, ENSR Corporation, to work cooperatively to develop protocols for conducting HHRAs and ERAs that would meet agency guidelines and scientific and public scrutiny. Weekly conference calls were held among the participants beginning in May 2002, and continuing through November 2002. A meeting was held in Boise on September 12-13, 2002, and in Denver, Colorado, on November 5-6, 2002, to discuss the risk assessment protocols. Conference calls were held intermittently from November 2002 through July 2003 to resolve remaining issues related to the protocols. Conference calls were also held among agency participants during preparation of the risk assessments. The final HHRA and ERA protocols were finalized and submitted to the Services and USEPA in August 2003. These protocols detail the methodology used to evaluate ecological and human health risks associated with the use of chemicals for controlling invasive vegetation and to determine whether these chemicals are safe for use by the BLM. The risk assessments evaluated a variety of possible exposure scenarios.

Cultural and Historic Resource Consultation

The BLM consulted with State Historic Preservation Officers as part of Section 106 consultation under the National Historic Preservation Act to determine how treatments with the three new herbicides could impact cultural resources listed on or eligible for inclusion in the National Register of Historic Places. Formal consultations with State Historic Preservation Officers and Indian Tribes also may be required during implementation of individual projects. Consultations with State Historic Preservation Officers are ongoing and will be completed by the time of the signing of the Record of Decision.

Government-to-government Consultation

Federally recognized tribes have a unique legal and political relationship with the government of the United States, as defined by the U.S. Constitution, treaties, statutes, court decisions, and executive orders. These definitive authorities also serve as the basis for the federal government's obligation to acknowledge the status of federally recognized tribes.

The BLM consults with federally recognized tribes, consistent with the Presidential Executive Memorandum dated April 29, 1994, on *Government-to-Government Relations with Native American Tribal Governments*; and Executive Order 13175 dated November 6, 2000, on *Consultation and Coordination with Indian Tribal Governments*.

Policies enacted by the USDOI during August of 2012 require federal agencies to consult with Alaska Native Corporations—the entities created under the Alaska Native Claims Settlement Act (ANCSA) of 1971—on the same basis as American Indian or Alaska Native Tribes.

The BLM formally consults with federally recognized tribes and Alaska Native Corporations before making decisions or undertaking activities that will have a substantial, direct effect on federally recognized tribes, or their assets, rights, services, or programs. To this end, formal government-to-government consultation with federally recognized traditional governments and Alaska Native Corporations was initiated by written correspondence in April 2013 (see Appendix B).

The letter sent to all of the tribal governments and Alaska Native Corporations described the proposed action. The tribes and native corporations were provided with information on the project and were asked to provide the BLM with any concerns they might have about vegetation treatments with any of the three new active ingredients and their impacts on subsistence, religious, and ceremonial purposes and traditional cultural properties. The BLM also invited the tribes and native corporations to call if they had questions or concerns, or wanted additional information.

The BLM prepared an Alaska National Interest Land Conservation Act (ANILCA) Section 810 analysis of subsistence impacts to evaluate the potential impacts to subsistence pursuits in Alaska. This analysis is found in Appendix C of this PEIS.

List of Preparers of the Programmatic EIS and BA

The following specialists (and company/agency and area of specialty) that participated in the development of this PEIS are listed below (Table 5-1). Because much of the information in this PEIS was summarized or incorporated by reference from the 2007 PEIS, the people who contributed to the 2007 PEIS also contributed to the current document. Those individuals, though not listed here, are included by reference (USDOI BLM 2007a: 5-5 to 5-9). Agencies included the BLM, USEPA, USFWS, and NMFS. Subcontractors that provided assistance to the BLM during preparation of the PEIS included AECOM (previously ENSR Corporation); Historical Research Associates (HRA); Planera, Inc. (Planera); and Paleo Consultants.

TABLE 5-1
List of Preparers of the Programmatic EIS/BA

Contributor	Areas of Specialty	Years of Experience	Highest Degree/Education
Bureau of Land Management			
Francis Ackley	Wild Horses and Burros	29	B.S., Range and Forest Management
Cathi Bailey	Wild and Scenic Rivers	27	B.S., Wildland Recreation Management
Jerry Cordova	Native American and Alaska Native Issues and Tribal Liaison Coordinator	40	B.S., Political Science and Native American Studies
Scott Davis	Soil and Water Science, Forestry, Ecology	39	M.S., Soil and Water Science
Mike DeArmond	Vegetation, Range, Emergency Stabilization and Rehabilitation, Riparian Areas	35	B.S., Forest Management
Melissa Dickard	Wetlands and Riparian Areas	11	M.S., Wildlife and Fisheries Science
Scott Feldhausen	Fish and Fish Habitat, and Threatened, Endangered, and Sensitive Species Consultation	25	B.S., Fisheries
Coreen Francis	Forestry and Woodland Resources	21	M.F., Silviculture

TABLE 5-1 (Cont.)
List of Preparers of the Programmatic EIS/BA

Contributor	Areas of Specialty	Years of Experience	Highest Degree/Education
Eric Geisler	Alaska State Program Lead Forestry, Weeds, Botany, Soils, Range, Emergency Stabilization and Rehabilitation,	40	Master of Management and Administration
Krista Gollnick-Wade	Fire and Fuels Management	30	M.S., Fire Ecology and Environmental Management
Leonard Gore	Data Coordinator	14	M.S., Geography
Doug Herrema	Special Areas (NLCS)	7	J.D., Law
Mike "Sherm" Karl	Plant Ecology, Livestock Grazing Management, Terrestrial Vegetation, and Rangelands	32	Ph.D., Rangeland Ecology
Lee Koss	Surface Water, Hydrology, and Riparian Restoration	43	B.S., Water Resource Management, Civil and Engineering, and Biology
Richard Lee	Herbicide Use and Management, Integrated Pest Management	30	Ph.D., Weed Science
Dave Maxwell	Air Quality, Smoke Management, and Climate	40	M.S., Air Pollution M.B.A., Business M.P.A., Public Administration
John McCarty	Visual Resource Management	32	B.S., Landscape Architecture
Dorothy Morgan	Recreation	20	B.S. Recreation and Parks Management
Arie Pals	Public Affairs	2	M.A., Sustainable Development Practice
Frank Quamen	Spatial Data Analyst	6	Ph.D., Wildlife Biology
Gina Ramos	Project Manager and Weed Management, Invasive Species, Pesticide Use, Range Management, and Economics	33	B.S., Range Science M.B.A., Business Administration
John Sherman	Wildlife Habitat	31	B.S., Wildlife Science and Microbiology
Josh Sidon	Economic Conditions and Social Environment	8	Ph.D., Economics
Carol Spurrier	Native Plant Communities, Species of Concern, and Threatened and Endangered Plants	34	M.S., Biology
Jeanne Standley	Natural Resources Specialist	23	B.S., Rangeland Resources
Paul Summers	Groundwater Hydrology and Water Resources	44	B.S., Geology and Water Resources
Rob Sweeten	Visual Resource Management	14	B.L., Landscape Architecture and Environmental Planning
Peter Teensma	Fire Ecology, Fire Management, and Air Quality Management	28	Ph.D., Geography
Kim Tripp	Threatened and Endangered Animals	18	M.S., Zoology
Jennifer Whyte	Rights-of-Way	7	M.P.A, Public Administration
Dana Wilson	Public Affairs	5	M.P.P., Public Policy
Kate Winthrop	Native American and Alaska Native Issues, Paleontology, Cultural and Historic Resources	35	Ph.D., Anthropology

TABLE 5-1 (Cont.)
List of Preparers of the Programmatic EIS/BA

Contributor	Areas of Specialty	Years of Experience	Highest Degree/Education
AECOM			
Alan Abramowitz	Archaeology and Anthropology	12	M.A., Anthropology
Kim Anderson	Vegetation, Species of Concern, Assistant Project Manager	15	M.S., Environmental and Forest Biology
Christine Archer	Ecological Risk Assessment	10	B.S., Zoology
Suzy Baird	Ecological Risk Assessment	7	M.S., Toxicology
Lisa Bradley	Human Health Risk Assessment	23	Ph.D., Toxicology
Sarah Esterson	Air Quality/Greenhouse Gases	9	M.S., Public Administration
Michael Inman	Graphics	9	B.S., Geography
Amanda MacNutt	Air Quality Dispersion Modeling	13	B.S., Meteorology
Adrienne Kieldsing	Ecological Risk Assessment	8	M.S., Environmental Science with a specialty in Atmospheric Studies
Glen Mejia	Fish, Wildlife, Livestock, Wild Horses and Burros	17	B.A., Environmental Studies and Biology
Tina Mirabile	Water Resources	14	M.B.A., Business Administration
Robert Paine	Air Quality	31	M.S., Meteorology
Melissa Paliouras	Ecological Risk Assessment	7	B.S., Environmental Science
Stuart Paulus	Project Manager, NEPA Specialist, and Wildlife Ecology	34	Ph.D., Wildlife Ecology
Colin Plank	Ecological and Human Risk Assessment, GLEAMS Modeling	12	M.S., Geology
Kelly Vosnakis	Human Health Risk Assessment	11	M.S., Civil and Environmental Engineering and Environmental Health
Frank Vertucci	Ecological Risk Assessment	27	Ph.D., Ecology and Evolutionary Biology
Kristen Durocher	Ecological Risk Assessment	11	M.S., Natural Resources and Terrestrial Ecology

CHAPTER 6

REFERENCES

CHAPTER 6

REFERENCES

Abella, S.R. 2008. A Systematic Review of Wild Burro Grazing Effects on Mojave Desert Vegetation, USA. Environmental Management DOI 10.1007/s00267-008-9105-7.

Agee, J.K. 1993. Fire Ecology of Pacific Northwest Forests. Island Press. Washington, D.C.

AECOM. 2013. Scoping Summary Report for the Vegetation Treatments Using Aminopyralid, Fluroxypyr, and Rimsulfuron on Bureau of Land Management Lands in 17 Western States Programmatic Environmental Impact Statement. Seattle, Washington.

_____. 2014a. Aminopyralid Ecological Risk Assessment Final Report. Prepared for the USDOI BLM. Manchester, New Hampshire.

_____. 2014b. Fluroxypyr Ecological Risk Assessment Final Report. Prepared for the USDOI BLM. Manchester, New Hampshire.

_____. 2014c. Rimsulfuron Ecological Risk Assessment Final Report. Prepared for the USDOI BLM. Manchester, New Hampshire.

_____. 2014d. Final Human Health Risk Assessment. Prepared for the USDOI BLM. Manchester, New Hampshire.

Allen, M.F. 1991. Ecology of Mycorrhizae. Cambridge University Press. Cambridge, United Kingdom.

American Cancer Society. 2012. Lifetime Risk of Developing or Dying From Cancer. Available at: http://www.cancer.org.

Asher, J.E., and S.A. Dewey. 2005. Estimated Annual Rates of Weed Spread on Western Federal Wildlands. Draft White Paper. Federal Interagency Committee for Management of Noxious and Exotic Weeds (FICMNEW). Washington, D.C.

Bailey, R.G. 1997. Map: Ecoregions of North America (Revised; Scale: 1:15,000,000). U.S. Department of Agriculture Forest Service in Cooperation with the Nature Conservancy and the U.S. Geological Survey. Washington, D.C.

_____. 2002. Ecoregions. Pages 235-245 *in* The Physical Geography of North America (A.R. Orme, ed.). Oxford University Press. Oxford, England.

Balch, J.K., B.A. Bradley, and J. Gomez-Dans. 2013. Introduced Annual Grass Increases Fire Activity Across the Arid Western USA. Global Change Biology 19: 173-183.

Barbash, J.E., G.P. Thelin, D.W. Kolpin, and R.J. Gilliom. 1999. Distribution of Major Herbicides in Ground Water of the United States. Water-resources Investigations Report 98-4245.

Barrett, S., D. Havlina, J. jones, C. Frame, D. Hamilton, K. Schon, T. Demeo, L. Hutter, and J. Menakis. 2010. Interagency Fire Regime Condition Class Guidebook. Version 3.0. The Interagency Fire Regime Condition Class Website. USDA Forest Service, U.S. Department of the Interior and The Nature Conservancy. Available at: http://www.frcc.gov.

Battaglin, W.A., E.M. Thurman, S.J. Kalkhoff, and S.D. Porter. 2003. Herbicides and Transformation Products in Surface Waters of the Midwestern United States. Journal of the American Water Resources Association 39:743-756.

Beck, K.G. No date. Downy Brome (*Bromus tectorum*) and Japanese Brome (*Bromus japonicas*) Biology and Management. Colorado State University Department of Bioagricultural Sciences and Pest Management. Fort Collins, Colorado.

Bell, J.L., M.R. Manucheri, H, Malone., and I.C. Burke. 2012. Absorption and Translocation of Aminopyralid and Clopyralid in Rush Skeletonweed. Proceedings – Western Society of Weed Science 65.

Belnap, J. 1994. Potential Role of Cryptobiotic Soil Crust in Semiarid Rangelands. Pages 179-185 *in* Proceedings—Ecology and Management of Annual Rangelands. (S.B. Monsen and S.G. Kitchen, eds.). General Technical Report INT-GTR-313. U.S. Department of Agriculture Forest Service, Intermountain Research Station. Ogden, Utah.

_____. 1995. Surface Disturbances: Their Role in Accelerating Desertification. Environmental Monitoring and Assessment 37:39-57.

_____, and J.S. Gardner. 1993. Soil Microstructure of the Colorado Plateau: The Role of the Cyanobacterium *Microcoleus vaginatus*. Great Basin Naturalist 53:40-47.

_____, and D.A. Gillette. 1998. Vulnerability of Desert Soil Surfaces to Wind Erosion: Impacts of Soil Texture and Disturbance. Journal of Arid Environments 39:133-142.

_____, R. Rosentreter, S. Leonard, J.H. Kaltenecker, J. Williams, and D. Eldridge. 2001. Biological Soil Crusts: Ecology and Management. U.S. Department of the Interior, Bureau of Land Management, National Science and Technology Center. Report Technical Reference 1730-2. Denver, Colorado.

Bonneville Power Administration. 2000. Transmission System Vegetation Management Program Final Environmental Impact Statement. Portland, Oregon.

Bossard, C.C., J.M. Randal, and M.C. Hoshovsky (eds.). 2000. Invasive Plants of California's Wildlands. University of California Press. Berkeley, California.

Bovey, R.W. 2001. Woody Plants and Woody Plant Management. Marcel Dekker, Inc. New York, New York.

Brady, N.C., and R.R. Weil. 2002. The Nature and Properties of Soils (13th Edition). Prentice-Hall, Inc. Upper Saddle River, New Jersey.

Brown, J.K. 1995. Fire Regimes and Their Relevance to Ecosystem Management. 1995. Pages 171 to 178 *in* Proceedings of Society of American Foresters National Convention, September 18-22, 1994. Washington, D.C.

Brumhard, B., and Fuhr, J. 1992. Lysimeter Studies of Pesticides in the Soil. British Crop Protection Council Monograph 53: 103-114.

California Department of Pesticide Regulation. 2005. Public Report 2005-01. Fluroxypyr. Tracking ID 197141 N. Available at: http://www.cdpr.ca.gov/docs/registration/ais/publicreports/5768.pdf.

California Environmental Protection Agency (CalEPA). 1996. Memorandum from T. Formoli (California Environmental Protection Agency, Department of Pesticide Regulation, Worker Health and Safety Branch) to M. Mason (California Environmental Protection Agency, Department of Pesticide Regulation, Pesticide Regulation Branch). Sacramento, California.

Cederlund, H., E. Borjesson, E. Jonsson, and T. Thierfelder. 2012. Degradation and Leaching of Fluroxypyr after Application to Railway Tracks. Journal of Environmental Quality 41:1884-1892.

Centers for Disease Control and Prevention. 2011. Deaths and Mortality in 2010. Available at: http://www.cdc.gov/nchs/fastats/deaths.htm.

Clarke, S.E., and S.A. Bryce (eds.). 1997. Hierarchical Subdivisions of the Columbia Plateau and Blue Mountains Ecoregions, Oregon and Washington. General Technical Report PNW-GTR-395. U.S. Department of Agriculture Forest Service, Pacific Northwest Research Station. Portland, Oregon.

Clements, D.D., and D.N. Harmon. 2013. Imazapic, Rimsulfuron, and Sulfometuron Methyl Effectiveness at Controlling Cheatgrass [abstract]. Soil and Water Conservation Society International Meeting, Reno, Nevada, July 21-24, 2013. Pages 68-79.

_____, _____, and R.R. Blank. 2012. Cheatgrass Invasion and Wildlife Habitat [abstract]. Nevada Wildlife Commission. Reno, Nevada.

Council on Environmental Quality (CEQ). 2010. National Environmental Policy Act (NEPA) Draft Guidance, "Consideration of the Effects of Climate Change and Greenhouse Gas Emissions." Federal Register 75(35): 8046.

Cummings, D.C., and K. Duncan. 2009. Control of Cholla and Prickly Pear with Picloram and Fluroxypyr. Abstract for Poster Session. Proceedings of the Western Society of Weed Science 62:7.

Dexter, A.G. 1993. Herbicide Spray Drift. North Dakota State University Extension Service Fact Sheet A-657 (revised). Available at: http://www.ext.nodak.edu/extpubs/plantsci/weeds/a657w.htm.

DiTomaso, J.M. 2012. Milestone (Aminopyralid) Applied Preemergence Can Control Medusahead. University of California Weed Science Blog. Available at: http://ucanr.edu/blogs/blogcore/postdetail.cfm?postnum=7658.

_____, and G.B. Kyser. 2006. Evaluation of Imazapyr and Aminopyralid for Invasive Plant Management. Proceedings of the California Weed Science Society 58: 107-109.

_____, G.B. Kyser, S.R. Oneto, R.G. Wilson, S.B. Orloff, L.W. Anderson, S.D. Wright, J.A. Roncoroni, T.L. Miller, T.S. Prather, C. Ransom, K.G. Beck, C. Duncan, K.A. Wilson, and J.J. Mann. 2013. Weed Control in Natural Areas in the Western United States. University of California at Davis Weed Research and Information Center. Davis, California.

Dow AgroSciences. 2005. Aminopyralid Technical Bulletin. Available at: http://msdssearch.dow.com/PublishedLiteratureDAS/dh_0052/0901b80380052fe6.pdf?filepath=usag/p

_____. 2014. Range and Pasture: Aminopyralid Stewardship. Available at: http://www.dowagro.com/range/aminopyralid_stewardship.htm.

Duncan, C.L., and J.K. Clark (eds.). 2005. Invasive Plants of Range and Wildlands and Their Environmental, Economic, and Social Impacts. Weed Science Society of America. Lawrence, Kansas.

EcoWest. 2014. National Wildfire Trends. Summarized Based on Data from the National Interagency Fire Center. Available at: http://www.ecowest.org/fires/trends/.

Eldridge, D.J., and R.S.B. Greene. 1994. Microbiotic Soil Crusts: A Review of Their Roles in Soil and Ecological Processes in the Rangelands of Australia. Australian Journal of Soil Research 32: 389-415.

Emmerich, F.L., F.H. Tipton, and J.A. Young. 1993. Cheatgrass: Changing Perspectives and Management Strategies. Rangelands 15(1):37-40.

Enloe, S.F., R.G. Lym, R. Wilson, P. Westra, S. Nissen, G. Beck, M. Moechnig, V. Peterson, R.A. Masters, and M. Halstvedt. 2007. Canada Thistle (Cirsium arvense) Control with Aminopyralid in Range, Pasture, and Non-Crop Areas. Weed Technology. 2007. 21:890-894.

_____, G.B. Kyser, S.A. Dewey, and V. Peterson, J.M. DiTomaso. 2008. Russian Knapweed (Acroptilon repens) Control with Low Rates of Aminopyralid on Range and Pasture. Invasive Plant Science and Management 1(4):385-389.

ENSR. 2004. Vegetation Treatments Programmatic EIS Ecological Risk Assessment Protocol. Prepared for the U.S. Department of the Interior Bureau of Land Management, Nevada State Office, Reno, Nevada. Westford, Massachusetts.

_____. 2005. Annual Emissions Inventory for BLM Treatment Methods. Prepared for the U.S. Department of the Interior Bureau of Land Management, Nevada State Office, Reno, Nevada. Westford, Massachusetts.

Evans, R.D., and J.R. Ehleringer. 1993. A Break in the Nitrogen Cycle in Aridlands? Evidence from ^{15}N isotope of Soils. Oecologia 94:314-317.

Fast, B.J. 2010. Aminopyralid Fate in Plant Tissues and Soil. PhD Dissertation. University of Florida. Gainesville, Florida.

Federal Geographic Data Committee. 1997. Vegetation Classification Standard. Vegetation Subcommittee. Reston, Virginia..

_____. 2008. National Vegetation Classification Standard, Version 2. FGDC-STD-005-2008 (Version 2). Reston, Virginia. Available at: http://www.fgdc.gov/standards/projects/FGDC-standards-projects/vegetation/NVCS_V2_FINAL_2008-02.pdf.

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. Environmental Toxicology and Chemistry 13(9):1383-1391.

Gay, D.L., D.M. Engle, E.R. Allen, and J.F. Stritzke. 1997. Nitrogen and Biomass Dynamics Following Brush Control in the Cross Timbers. Journal of Range Management 50:55-61.

Gebhardt, K., S. Leonard, G. Staidl, and D. Prichard. 1990. Riparian Area Management: Riparian and Wetland Classification and Review. USDOI, BLM /YA/PT-91/002+1737. Denver, Colorado.

Germano, D.J. 1978. Response of Selected Wildlife to Mesquite Removal in Desert Grassland. M.S. Thesis. University of Arizona. Tucson, Arizona.

_____, G.B. Rathbun, and L.R. Saslaw. 2001. Managing Exotic Grasses and Conserving Declining Species. Wildlife Society Bulletin 29(2): 551-559.

Green, P., V.F. Peterson, C. Crabtree, T. Prather, and J. Wallace. 2011. Effects of Aminopyralid on Native Forbs and Grasses. Proceedings of the Western Society of Weed Science. Volume 64, Papers Presented at the Annual Meeting, March 7-10, 2011, Spokane, Washington.

Griffith, S.M. 2004. Restoring California's Native Grass. Rangeland, Pasture, and Forages, an ARS National Program (#205). Available at: http://www.ars.usda.gov/is/ar/archive/may04/grass0504.pdf.

Groot, C., and L. Margolis. 1991. Pacific Salmon Life Histories. UBC Press, Vancouver, British Columbia, Canada.

Gruell, G.E. 1983. Fire and Vegetative Trends in the Northern Rockies: Interpretations from 1871-1982 Photographs. General Technical Report INT-158. U.S. Department of Agriculture Forest Service Intermountain Research Station. Ogden, Utah.

Halstvedt, M.B., V.F. Peterson, K.G. Beck, M.J. Moechnig, and P.M. Rice. 2011. The Effect of Application Timing on Forb Tolerance to Aminopyralid. Proceedings of the Western Society of Weed Science. Volume 64, Papers Presented at the Annual Meeting, March 7-10, 2011, Spokane, Washington.

Harper, B.L., B. Flett, S. Harris, C. Abeyta, and F. Kirschner. 2002. The Spokane Tribe's Multipathway Subsistence Exposure Scenario and Screening Level RME. Risk Analysis 22(3):513-526.

Harper K., and J. Belnap. 2001. The Influence of Biological Soil Crusts on Mineral Uptake by Associated Vascular Plants. Journal of Arid Environments 47(3):347-357.

Harrington T.B., D.H. Peter, and W. Devine. 2011. The Effects of Aminopyralid on a Meadow Community Invaded by Canada Thistle in the Washington Cascades. Proceedings of the Western Society of Weed Science. Volume 64, Papers Presented at the Annual Meeting, March 7-10, 2011, Spokane, Washington.

Harris, S.G., and B.L. Harper. 1997. A Native American Exposure Scenario. Risk Analysis 17(6):789-795.

Health Canada. 2012. Proposed Registration Decision PRD 2012-18, Fluroxypyr. Available at: http://www.hc-sc.gc.ca/cps-spc/pest/part/consultations/_prd2012-18/prd2012-18-eng.php.

Hein, L. 2002. Checklist for the Potential Costs of Land Degradation and the Benefits of Mitigation Measures. Prepared for The International Centre for Environmental Assessment Foundation for Sustainable Development and The International Centre for Integrative Studies. Medaction Work Package 1.3 Deliverable 12. Maastricht, Netherlands

Hergert, H.J., B.A. Mealor, A.R. Kniss, and R.D. Mealor. 2012. Effects of Preemergence Application of Rimsulfuron, Imazapic, and Aminocyclopyrachlor on Downy Brome. Poster Abstract – Western Society of Weed Science Annual Meeting 2012. Reno, Nevada.

Hirsch, M.C., T.A. Monaco, C.A. Call, and C.V. Ransom. 2012. Comparison of Herbicides for Reducing Annual Grass Emergence in Two Great Basin Soils. Rangeland Ecology and Management 65(1):66-75.

Hofman, V., and E. Solseng. 2001. Reducing Spray Drift. North Dakota State University Extension Service, Agricultural and Biosystems Engineering. Fargo, North Dakota.

Ingham, E.R., No Date. Soil Food Web. USDA Natural Resources Conservation Service. Available at: http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/soils/health/biology/?cid=nrcs142p2_053868.

Iowa State University. 2006. Aminopyralid – New Herbicide for Pastures, Roadsides, Etc. Available at: http://www.weeds.iastate.edu/mgmt/2006/aminopyralid.shtml.

Jensen, M., I. Goodman, K. Brewer, T. Frost, G. Ford, and J. Nesser. 1997. Biophysical Environments of the Basin. Pages 99-320 *in* An Assessment of Ecosystem Components in the Interior Columbia Basin and Portions of the Klamath and Great Basins (T.M. Quigley and S.J. Arbelbide, tech. eds.). General Technical Report PNW-GTR-405. U.S. Department of Agriculture Forest Service, Pacific Northwest Research Station. Portland, Oregon.

Johnson, D.D., and K.W. Davies. 2012. Medusahead Management in Sagebrush-Steppe Rangelands: Prevention, Control, and Revegetation. Rangelands 34(1):32-38.

Kansas State University. 1991. Rangeland Weed Management. Available at: http://www.ksre.ksu.edu/bookstore/pubs/mf1020.pdf.

Kelsey, R.G., and D.J. Bedunah. 1989. Ecological Significance of Alleopathy for Centaurea Species in the Northwestern United States. Knapweed Symposium Proceedings, Land and Soil Science Department and Extension Service. Montana State University Bulletin 45:10-31.

Lacey, J.R., C.B. Marlow, and J.R. Lane. 1989. Influence of Spotted Knapweed (*Centaurea macuolosa*) on Surface Runoff and Sediment Yield. Weed Technology 3:627-631.

Landfire. 2010. Vegetation Condition Class, Coterminous United States. Raster Digital Data Prepared for USDA Forest Service Contract #AG-024B-C-10-022. Missoula, Montana.

_____. 2011. Vegetation Condition Class, Alaska. Raster Digital Data Prepared for USDA Forest Service Contract #AG-0024B-C-022. Missoula, Montana.

LaPrade, J.C. 1992. Fate of Pesticides in Soil and Water. Alabama Cooperative Extension System, Community Resource Development, Auburn University Document Number ANR-737. Auburn, Alabama. Available at: http://www.aces.edu/pubs/docs/A/ANR-0737/.

Lee, R. 2013. BLM Integrated Pest Management Specialist, USDOI BLM National Operations Center, Denver, Colorado. Electronic Mail Communication with K. Anderson, AECOM, Seattle, Washington, Regarding Herbicide Summary Table 2-2, March 5, 2013.

Lehmann, R.G. 1991. Environmental Fate of a Herbicide: An Industrialists Perspective. Journal of Agronomy Education 20:96-101.

_____, J.R. Miller, E.L. Olberding, P.M. Tillotson, and D.A. Laskoswki. 1990. Fate of Fluroxypyr in Soil: I. Degradation Under Laboratory and Greenhouse Conditions. Weed Research 30:375-382.

Lindenmeyer, B. 2012. Understanding Aminocyclopyrachlor Behavior in Soil and Plants. Ph.D. Dissertation. Colorado State University. Fort Collins, Colorado.

McCormick, D.P. 1975. Effect of Mesquite Control on Small game Populations. M.S. Thesis, University of Arizona. Tucson, Arizona.

Metzger, L.O.Y., C. Munier-Lamy, T. Choné, F. Andreux, M.J. Belgy, J.M.F. Martins, and A. Mermoud. 1998. Fate of the Sulfonylurea Herbicide Rimsulfuron in Soil: Mobility and Interactions with Soil Constituents (Poster). Proceedings of the 16th World Congress of Soil Science.

Mikkelson, J.R., and R.G. Lym. 2013. Effect of Aminopyralid on Desirable Forb Species. Invasive Plant Science and Management 6(1):30-35.

Miller, R.F., S.T. Knick, D.A. Pyke, C.W. Meinke, S.E. Hanser, M.J. Wisdom, and A.L. Hild. 2011. Characteristics of Sagebrush Habitats and Limitations to Long-term Conservation. Pages 145-184 *in* S.T. and J.W. Connelly (eds.). Greater Sage-Grouse: Ecology and Conservation of a Landscape Species and Its Habitats. University of California Press. Berkeley, California.

Mitsch, W.J., and J.G. Gosselink. 2000. Wetlands (Third Edition). John Wiley and Sons, Inc. New York, New York.

Montana Department of Environmental Quality. 2007. State of Montana Modeling Guideline for Air Quality Permit Applications. Available at: http://deq.mt.gov/AirQuality/docs/MontanaModelingGuidelineForAirQualityPermits(3).pdf.

Montana State University Extension. 2011. Preventing and Managing Herbicide-Resistant Weeds in Montana. Bozeman, Montana.

National Academy of Sciences. 1983. Risk Assessment in the Federal Government: Managing the Process. National Academy Press. Washington, D.C.

National Groundwater Association. 2010. Groundwater Facts. Available at: http://www.ngwa.org/Fundamentals/use/Pages/Groundwater-facts.aspx.

National Institute of Occupational Safety and Health. 2012. Traumatic Occupational Injuries. Available at: http://www.cdc.gov/niosh/injury/.

National Interagency Fire Center. 2014. Wildland Fire Fatalities by Year. Available at: https://www.nifc.gov/safety/safety_documents/Fatalities-by-Year.pdf.

National Interagency Fuels Technology Transfer. 2010. Interagency Fire Regime Condition Class (FRCC) Guidebook. Version 3.0. USDA Forest Service Rocky Mountain Research Station. Fort Collins, Colorado.

National Library of Medicine. 2011. Fluroxypyr. Toxicology Data Network HSDB Database. Available at: http://toxnet.nlm.nih.gov/cgi-bin/sis/search/a?dbs+hsdb:@term+@DOCNO+6655.

National Park Service. 2007. Class I Area Boundaries Digital Data. Air Resources Division. Denver, Colorado.

Neary, D.G., Ryan, K.C., and DeBano, L.F. (eds.). 2005. (revised 2008). Wildland Fire in Ecosystems: Effects of Fire on Soils and Water. General Technical Report RMRS-GTR-42-vol.4. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Ogden, Utah.

New York State Department of Environmental Conservation (NYSDEC). 1997. Registration of a New Active Ingredient-Rimsulfuron Contained in the Pesticide Products Matrix Herbicide (EPA Reg. No. 352-556), Basis Herbicide (EPA Reg. No. 352-571, and Basis Gold Herbicide (EPA Reg. No 352-585). Letter to Donna M. Factor, E.I. DuPont De Nemours Dated August 15, 1997. Albany, New York.

_____. 2006. Registration of Vista and Spotlight Herbicide (EPA Reg. No. 62719-308) Which Contain the New Active Ingredient: Fluroxypyr (Chemical Code: 128968). Letter to Jim Baxter, Dow AgroSciences, LLC Dated May 2, 2006. Albany, New York.

_____. 2009. Registration of a Major Change in Labeling for DuPont Matrix FNV Herbicide (EPA Reg. No. 352-671) Containing the Active Ingredient Rimsulfuron (Active Ingredient Code 129009). Letter to Tim McPherson, DuPont Crop Protection Dated May 15, 2009. Albany, New York.

Norton, J.B., T.A. Monaco, J.M. Norton, D.A. Johnson, and T.A. Jones. 2004. Cheatgrass Invasion Alters Soil Morphology and Organic Matter Dynamics in Big Sagebrush—Steppe Rangelands. *In* Seed and Soil Dynamics in Shrubland Ecosystems: Proceedings, August 12-16, 2002 (A.L. Hild, N.L. Shaw, S.E. Meyer, D.T. Booth, and E.D. McArthur, eds.). U.S. Department of Agriculture Forest Service, Rocky Mountain Research Station. Laramie, Wyoming.

Olson, B.E. 1999a. Grazing and Weeds. Pages 85-97 *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. 1999b. 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.

_____, and R.T. Wallander. 1997. Biomass and Carbohydrates of Spotted Knapweed and Idaho Fescue After Repeated Grazing. Journal of Range Management 50:409-412.

Oregon Department of Agriculture. 2013. Medusahead Rye (*Taeniatherum canput-medusae*). ODA Plant Programs, Noxious Weed Control. Available at: http://www.oregon.gov/ODA/PLANT/WEEDS/Pages/profile_medusaheadrye.aspx.

Oregon State University. 2009. Herbicide Carryover in Hay, Manure, Compost, and Grass Clippings. Available at: http://smallfarms.oregonstate.edu/sfn/f09Herbicide.

_____. 2011. Aminopyralid Residues in Compost. Available at: http://smallfarms.oregonstate.edu/sfn/wtr11Aminopyralid.

Oshida, C.M. 2011. The Effect of Herbicide on Stone and Masonry Material. Master of Historic Preservation Thesis. University of Georgia. Athens, Georgia.

Pellant, M. 1996. Cheatgrass: The Invader that Won the West. Bureau of Land Management Idaho State Office. Boise, Idaho.

Peterjohn, W.T., and W.H. Schlesinger. 1990. Nitrogen Loss from Deserts in the Southwestern United States. Biogeochemistry 10:67-79.

Peterson, M.A. 1989. Control of Leafy Spurge with Picloram and Fluroxypyr. 1989 Leafy Spurge Symposium. Bozeman Montana, July 12-13, 1989.

Peterson, V.F., J.J. Jachetta, P.L. Havens, L.A. Brinkworth, W.N. Kline, W.T. Haller, and J.L. Troth. 2013. Aminopyralid Research Summary for Aquatic Labeling. Proceedings of the Western Society of Weed Science. Volume 66, Papers Presented at the Annual Meeting, March 11-14, 2013, San Diego, California.

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 Residues on Plants. Environmental Toxicology and Chemistry 15(4):535-543.

Prichard, D., F. Berg, S. Leonard, W. Hagenbuck, M. Manning, R. Krapf, C. Noble, R. Leinard, and J. Staats. 2003. Riparian Area Management: A User Guide to Assessing Proper Functioning Condition and the Supporting Science for Lentic Areas. TR 1737-16, U.S. Department of the Interior Bureau of Land Management, BLM/RS/ST-99/001+1737+REV03. Denver, Colorado.

Radivojevic, L., L. Santric, and J.G. Umiljendic. 2011. Rimsulfuron in Soil: Effects on Microbiological Properties under Varying Soil Conditions. Pesticides and Phytomedicine 26(2): 135-140.

Ramos, G. 2014. BLM. Senior Weeds Specialist. Washington, D.C. Electronic Mail Communication with K. Anderson, AECOM, Seattle, Washington. Regarding Treatment Costs. February 25, 2014.

Rinella, M.J., R.A. Masters, and S.E. Bellows. 2013. Effects of Growth Regulator Herbicide on Downy Brome (*Bromus tectorum*) Seed Production. Invasive Plant Science and Management 6(1):60-64.

Rosenbom, A.E., J.K. Jaer, and P. Olsen. 2010. Long-term Leaching of Rimsulfuron Degradation Products Through Sandy Agricultural Soils. Chemosphere 79(2010):830-838.

Rosentreter, R., M. Bowker, and J. Belnap. 2007. A Field Guide to Biological Soil Crusts of Western U.S. Drylands; Common Lichens and Bryophytes. U.S. Government Printing Office. Denver, CO.

Satterlund, D.R., and P.W. Adams. 1992. Wildland Watershed Management (2nd edition). John Wiley and Sons, Inc. New York, New York.

Schmidt, C., and R. Mulder. 2009. Groundwater and Surface Water Monitoring for Pesticides and Nitrate in the Bitterroot Valley, Montana. Montana Department of Agriculture. Helena, Montana.

Seaber, P.R., F.P. Kapinos, and G.L. Knapp. 1987. Hydrologic Unit Maps. U.S. Geological Survey Water-supply Paper 2294. Available at: http://water.usgs.gov/GIS/huc.html.

Sinclair, C.J. and A.B.A. Boxall. 2003. Assessing the Ecotoxicity of Pesticide Transformation Products. Environmental Science and Technology 37(20):4617-4625.

Sleugh, B.B., M.Halstvedt, V.F. Peterson, R.G. Wilson, G.M. Sbatella, S. Nissen, and B. Mealor. 2011. Aminopyralid + Triclopyr Control of Russian-Olive and Saltcedar: Maintaining Grass Understory. Proceedings of the Western Society of Weed Science. Volume 64, Papers Presented at the Annual Meeting, March 7-10, 2011, Spokane, Washington.

Smith, R.L., and S. Mitra. 2006. "Spotlight" a New Tool for Broadleaf Control in Turf. 2006 Proceedings of the California Weed Science Society 58:14-17.

Soil Quality Institute. 2001. Soil Quality – Introduction, Prepared by the Soil Quality Institute, National Soil Survey Center, Natural Resource Conservation Service, U.S. Department of Agriculture, and the National Tilth Laboratory, ARS, U.S. Department of Agriculture. Available at: http://soils.usda.gov/sqi/concepts/concepts.html.

Stoeckel, D.M., E.C. Mudd, and J.A. Entry. 1997. Degradation of Persistent Herbicides in Riparian Wetlands. Pages 114 to 132 *in* E.L. Kruger, T.A. Anderson, and J.R. Coats (eds.). Phytoremediation of Soil and Water Contaminants. ACS Symposium Series 664. American Chemical Society. Washington, D.C.

Stone, W.W., R.J. Gilliom, and K.R. Ryberg. 2014. Pesticides in U.S. Streams and Rivers: Occurrence and Trends During 1992-2011. Unpublished White Paper by the U.S. Geological Survey, Indianapolis, Indiana.

Swetnam, T. 1990. Fire History and Climate in the Southwest United States. Pages 6-17 *in* Proceedings of Symposium: Effects of Fire Management of Southwestern Natural Resources. General Technical Report RM-191. U.S. Department of Agriculture Forest Service Rocky Mountain Forest and Range Experiment Station. Fort Collins, Colorado.

Syracuse Environmental Research Associates, Inc. (SERA). 2007. Aminopyralid Human Health and Ecological Risk Assessment. Final Report. Prepared for USDA Forest Service and National Park Service. Syracuse, New York.

_____. 2009. Fluroxypyr Human Health and Ecological Risk Assessment. Final Report. Prepared for USDA Forest Service, Southern Region. Syracuse, New York.

Tao, L., and H. Yang. 2011. Fluroxypyr Biodegradation in Soils by Multiple Factors. Environmental Monitoring and Assessment (2011) 175:227-238.

Toevs, G.R., J.J. Taylor, C.S. Spurrier, and M.R. Bobo. 2011. Bureau of Land Management Assessment, Inventory, and Monitoring Strategy: For Integrated Renewable Resources Management. BLM National Operations Center. Denver, Colorado.

Turner, J.L., K. Duncan, and J. LeFevre. 2011. Russian Knapweed and Yellow Star Thistle Poisoning of Horses. Guide B-710. New Mexico State Cooperative Extension Service. Las Cruces, New Mexico.

Ueckert, D.N. 1997. Pricklypear Ecology. Texas A&M Agrilife Extension, Texas Natural Resources Server. Available at: http://texnat.tamu.edu/library/symposia/brush-sculptors-innovations-for-tailoring-brushy-rangelands-to-enhance-wildlife-habitat-and-recreational-value/pricklypear-ecology/.

University of Nevada Cooperative Extension. 1998. Forage Kochia. Fact Sheet 98-48. Available at: http://www.unce.unr.edu/publications/files/nr/other/fs9848.pdf.

U.S. Department of Agriculture (USDA) Agricultural Research Service. 2006. Tansy Ragwort (*Senecio jacobea*). Available at: http://www.ars.usda.gov/Services/docs.htm?docid=9988.

USDA Forest Service. 2004. Bailey's Ecoregions and Subregions of the United States, Puerto Rico, and the U.S. Virgin Islands. National Atlas of the United States. Reston, Virginia.

_____, and U.S. Department of the Interior Bureau of Land Management (USDOI BLM). 2000. Interior Columbia Basin Supplemental Draft Environmental Impact Statement. Boise, Idaho.

U.S. Department of Agriculture Natural Resources Conservation Service. 1996. Soil Quality Indicators: Organic Matter. Soil Quality Information Sheet Series. Natural Resources Conservation Service National Soil Survey Center in Cooperation with the Natural Resources Conservation Service Soil Quality Institute, and the Agricultural Research Services National Soil Tilth Lab. Available at: http://soils.usda.gov/sqi/publications/files/sq_fou_1.pdf.

_____. 2000 to Present. Digital General Soil Map. National Geospatial Center of Excellence. Fort Worth, Texas.

U.S. Department of Commerce Bureau of the Census. 2011. Washington, D.C. Available at: http://www.census.gov/.

_____. 2014. 2008-2012 American Community Survey. Available at: http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml

U.S. Department of Commerce Bureau of Economic Analysis. 2012. SA25N Total Full-Time and Part-Time Employment by NAICS Industry. Estimated Data for 2011. Available at: http://www.bea.gov/itable/.

U.S. Department of the Interior (USDOI). 2011. Payments in Lieu of Taxes. Available at: http://www.doi.gov/pilt/index.cfm.

_____. 2014. Budget Justifications and Performance Information Fiscal Year 2014, Wildland Fire Management. Available at: http://www.doi.gov/budget/appropriations/2014/upload/FY2014_WFM_Greenbook.pdf.

U.S. Department of the Interior Bureau of Land Management (USDOI BLM). 1980. Control of Salinity from Point Sources Yielding Groundwater Discharge and from Diffuse Surface Runoff in the Upper Colorado River Basin. BLM Service Center. Denver, Colorado.

_____. 1986a. Visual Resources Inventory. Handbook H- 8410-1. Washington, D.C.

_____. 1986b. Visual Resource Contrast Rating. Handbook H-8432-1. Washington, D.C.

_____. **1991.** Final Environmental Impact Statement Vegetation Treatment on BLM Lands in Thirteen Western States. BLM Wyoming State Office. Casper, Wyoming.

_____. **1992.** BLM Manual 9015 – Integrated Weed Management. Washington, D.C.

_____. **1999.** Out of Ashes, An Opportunity. National Office of Fire and Aviation. Boise, Idaho.

_____. **2000.** The Great Basin: Healing the Land. Washington, D.C.

_____. **2001.** Rangeland Health Standards. Handbook H-4180-1. Washington, D.C.

_____. **2004.** Burned Area Stabilization and Rehabilitation. Chapter 3 of BLM Manual 620, Wildland Fire Management. Washington, D.C.

_____. **2005.** United States Department of the Interior Land Use Planning Handbook. BLM Handbook H-1601-1. Washington, D.C.

_____. **2006.** BLM Forest Lands Report 2006: Status and Condition. BLM/ST/ST-07/001+5000. Ogden, Utah.

_____. **2007a**. Burned Area Emergency Stabilization and Rehabilitation. BLM Handbook H-1742-1. Washington, D.C.

_____. **2007a**. Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in 17 Western States Programmatic Environmental Impact Statement. Reno, Nevada.

_____. **2007b.** Record of Decision Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in 17 Western States Programmatic Environmental Impact Statement. Reno, Nevada.

_____. **2007c.** Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in 17 Western States Programmatic Environmental Report. Reno, Nevada.

_____. **2007d.** Public Land Statistics 2006. Volume 191. BLM/OC/ST-07/001+1165. Washington, D.C.

_____. **2007e.** Biological Assessment for Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in 17 Western States. Washington, D.C.

_____. **2008a.** National Environmental Policy Act. BLM Handbook H-1790-1. Washington, D.C.

_____. **2008b.** Public Land Statistics 2007. Volume 192. BLM/OC/ST-08/001+1165. Washington, D.C.

_____. **2009a.** Grazing Administration – Exclusive of Alaska (Public). BLM Manual M-4100. Washington, D.C.

_____. **2009b.** Public Land Statistics 2008. Volume 193. BLM/OC/ST-09/001+1165. Washington, D.C.

_____. **2009c.** Draft Dalton Management Area Integrated Invasive Plant Strategic Plan. Fairbanks, Alaska.

_____. **2010a.** Public Land Statistics 2009. Volume 194. BLM/OC/ST-10/001+1165. Washington, D.C.

_____. **2010b.** Wild Horses and Burros Management Handbook (H-4700-1). Wild Horse and Burro Program Office of the Assistant Director, Renewable Resources and Planning (WO-200). Washington, DC.

_____. **2011.** Public Land Statistics 2010. Volume 195. BLM/OC/ST-11/001+1165. Washington, D.C.

_____. **2012a.** Public Land Statistics 2011. Volume 196. BLM/OC/ST-12/001+1165. Washington, D.C

_____. **2012b.** Budget Justifications and Performance Information Fiscal Year 2013. Washington, D.C.

_____. **2012c.** Bureau of Land Management Get to Know Us. Available at: http://www.blm.gov/wo/st/en/res/Education_in_BLM/Learning_Landscapes/Get_to_Know_Us.html

_____. **2012d.** National Recreation Programs. Updated as of October 22, 2012. Available at: http://www.blm.gov/wo/st/en/prog/Recreation/recreation_national.html.

_____. **2012e.** BLM Manual 6340. Management of BLM Wilderness. Washington, D.C.

_____. **2012f.** BLM Manual 6330. Management of Wilderness Study Areas. Washington, D.C.

_____. **2013a.** Public Land Statistics 2012. Volume 197. BLM/OC/ST-13/002+1165. Washington, D.C.

_____. **2013b.** Oil and Gas Statistics. Available at: http://www.blm.gov/wo/st/en/prog/energy/oil_and_gas/statistics.html. Site updated on 1-07-2013.

_____. **2013c.** Geothermal Energy. Available at: http://www.blm.gov/wo/st/en/prog/energy/geothermal.html. Site updated on 1-07-2013.

_____. **2013d.** Fiscal Year 2012 Rangeland Inventory, Monitoring, and Evaluation Report. Washington, D.C.

_____. **2013e.** Livestock Grazing. Available at: http://www.blm.gov/wo/st/en/prog/grazing.html.

_____. **2013f.** National Scenic and Historic Trails. Updated as of April 4, 2013. Available at: http://www.blm.gov/wo/st/en/prog/blm_special_areas/NLCS/Trails.html.

_____. **2013g.** National Surface Management Agency Polygon Data Set. Denver, Colorado.

_____. **2013h.** National Landscape Conservation System Digital Data, compiled from various data sets from several years. Washington, D.C.

_____. **2013i.** Dalton Management Area Integrated Invasive Plant Strategic Plan Environmental Assessment. Central Yukon Field Office. Fairbanks, Alaska.

_____. **2014a.** Wild Horse and Burro Quick Facts. Updated as of June 11, 2014. Available at: http://www.blm.gov/wo/st/en/prog/whbprogram/history_and_facts/quick_facts.html.

_____. **2014b.** Budget Justifications and Performance Information Fiscal Year 2015. Washington, D.C.

_____. **2014c.** Net Nominal Wildfire Suppression Obligations 2004 to 2013. Data Provided by K. Gollnick-Wade, BLM Fuels Program Lead – Budget and Planning, Boise, Idaho.

_____. **2014d.** Reseeding Costs. Data Provided by M. Boyter, BLM Botanist. Spokane, Washington.

_____. **2014e.** Public Land Statistics 2013. Volume 198. BLM/OC/ST-14/004+1165. Washington, D.C.

_____. **2014f.** USDOI BLM. 2014. Sustainability/Energy Scorecard. Available at: http://www.doi.gov/greening/prfm_matrix/index.cfm.

_____. **2015.** Biological Assessment for Vegetation Treatments with Aminopyralid, Fluroxypyr, and Rimsulfuron on Bureau of Land Management Lands in 17 Western States. Washington, D.C.

U.S. Department of the Interior (USDOI) and U.S. Department of Agriculture (USDA). 2001. Managing the Impacts of Wildland Fires on Communities and the Environment. The National Fire Plan. Washington, D.C.

_____, **and** _____. **2006a.** A Collaborative Approach for Reducing Wildfire Risks to Communities and the Environment 10-Year Strategy Implementation Plan. Available at: http://www.forestsandrangelands.gov/resources/plan/documents/10-yearstrategyfinal_dec2006.pdf.

_____, **and** _____. **2006b.** Interagency Burned Area Rehabilitation Guidebook. Available at: http://www.forestsandrangelands.gov/resources/plan/documents/10-yearstrategyfinal_dec2006.pdf.

_____, **and** _____. **2014.** The National Strategy: The Final Phase in the Development of the National Cohesive Wildland Fire Management Strategy. Available at: http://www.forestsandrangelands.gov/strategy/documents/strategy/CSPhaseIIINationalStrategyApr2014.pdf.

U.S. Department of the Interior National Park Service. 2003. Invasive Exotic Plant Management Plan and Environmental Assessment. Rocky Mountain National Park, Colorado.

U.S. Department of Labor Bureau of Labor Statistics. 2013a. Occupational Employment Statistics. Available at: http://www.bls.gov/oes/#data.

_____. 2013b. Census of Fatal Occupational Injuries Summary, 2012. Available at: http://www.bls.gov/news.release/cfoi.nr0.htm.

_____. 2014. Local Area Unemployment Statistics. Available at: http://www.bls.gov/lau/.

U.S. Environmental Protection Agency (USEPA). 1998a. Fluroxypyr Pesticide Fact Sheet. Available at: http://www.epa.gov/opp00001/chem_search/reg_actions/registration/fs_PC-128959_30-Sep-98.pdf.

_____. 1998b. Guidelines for Ecological Risk Assessment. EPA/630/R-95/002F. Washington, D.C.

_____. 1998c. Freedom of Information Act Request. *In* Aerial Herbicide Spraying: Poisoning the Maine (and New Hampshire) Woods. Available at: http://www.forestecologynetwork.org/tmwfall99_05.html.

_____. 2004. Risk Assessment Guidance for Superfund. Volume 1: Human Health Evaluation Manual. Part E, Supplemental Guidance for Dermal Risk Assessment. Final Available at: http://www.epa.gov/oswer/riskassessment/ragse/pdf/part_e_final_revision_10-03-07.pdf.

_____. 2005a. National Management Measures to Protect and Restore Wetlands and Riparian Areas for the Abatement of Nonpoint Source Pollution. EPA 841-B-05-003. Washington, D.C.

_____. 2005b. Office of Prevention, Pesticides and Toxic Substances: Pesticide Fact Sheet – Aminopyralid. Issued August 10, 2005. Available at: http://www.epa.gov/opp00001/chem_search/reg_actions/registration/fs_PC-005100_10-Aug-05.pdf.

_____. 2005c. Environmental Fate and Ecological Risk Assessment for the Registration of Aminopyralid. Available at: http://www.epa.gov/opp00001/chem_search/cleared_reviews/csr_PC-005100_10-May-05_a.pdf.

_____. 2007. Fluroxypyr - Human Health Risk Assessment to Support Proposed New Uses on Pome Fruits and Millet. Report dated October 3, 2007. Available at: http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OPP-2007-0114-0004.

_____. 2009a. National Water Quality Inventory: Report to Congress. 2004 Reporting Cycle. EPA 841-R-08-001. Washington, D.C.

_____. 2009b. Aminopyralid – Human Health Risk Assessment for the Proposed Use on Field Corn (PP#8F7455). Available on-line at http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OPP-2009-0141-0006.

_____. 2010a. Greenhouse Gas Emissions. Available at: http://www.epa.gov/climatechange/ghgemissions/index.html.

_____. 2010b. Watershed Assessment, Tracking and Environmental Results. Available at: http://ofmpub.epa.gov/waters10/attains_state.control?p_state=AK.

_____. 2011. Rimsulfuron – Human Health Risk Assessment for Proposed Section 3 Uses on Caneberry and Bushberry. Office of Chemical Safety and Pollution Prevention. Available at: http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OPP-2010-1017-0005.

_____. 2012a. Pesticides: Regulating Pesticides. What is the Conventional Reduced Risk Pesticide Program? Available at: http://www.epa.gov/opprd001/workplan/reducedrisk.html.

_____. 2012b. National Ambient Air Quality Standards (NAAQS). Available at: http://www.epa.gov/air/criteria.html.

_____. **2012c.** The Green Book Nonattainment Areas for Criteria Pollutants As of December 14, 2012. Available at: http://www.epa.gov/oar/oaqps/greenbk/.

_____. **2012d.** Occupational Pesticide Handler Unit Exposure Surrogate Reference Guide. Office of Pesticide Programs. March 2012. Washington, D.C. Available at: http://www.epa.gov/pesticides/science/handler-exposure-table.pdf.

_____. **2012e.** Our Nation's Air – Status and Trends through 2010. Available at http://www.epa.gov/airtrends/2011/.

_____. **2013a.** Laws and Regulations, Summary of the Clean Water Act. Washington, D.C. Available at: http://www2.epa.gov/laws-regulations/summary-clean-water-act.

_____. **2013b.** Drinking Water Contaminants. Available at: http://water.epa.gov/drink/contaminants/index.cfm.

_____. **2014.** Greenhouse Gas Inventories. USEPA State and Local Climate and Energy Program. Available at: http://www.epa.gov/statelocalclimate/local/local-examples/ghg-inventory.html.

U.S. Fish and Wildlife Service. 2011. Five-Year Survey Shows Wetlands Losses are Slowing, Marking Conservation Gains and Need for Continued Investment in Habitat. October 6, 2011 News Release from Office of External Affairs. Available at: http://www.fws.gov/mountain-prairie/pressrel/11-doi-10-06-2011.html.

_____. **2013.** News Release: A New Biological Management Option against Cheatgrass Raises Hope of Western Land Managers. April 1, 2013. Available at: http://www.fws.gov/pacific/news/news.cfm?id=2144375216.

U.S. Fire Administration, 2013. Fire Statistics. Available at: http://www.usfa.fema.gov/statistics/.

U.S. Geological Survey (USGS). 1999. The Quality of Our Nation's Waters: Nutrients and Pesticides. Circular 1225. Reston, Virginia.

_____. **2002 to 2012.** National Maps from Featured NWQA Activities. National Water Quality Assessment Program. Available at: http://water.usgs.gov/nawqa/digmap.html.

_____. **2004.** Southwest Biological Research Center, Canyonlands Research Station. Moab, Utah. Available at: http://www.soilcrust.org/crust101.htm.

_____. **2005a.** Water Availability for the Western United States – Key Scientific Challenges. Circular 1261. Reston, Virginia.

_____. **2005b.** 1:2,000,000-Scale Hydrologic Unit Boundaries. Digital Data from the USGS Office of Water Data Collection. Reston, Virginia.

_____. **2006.** The Quality of our Nation's Waters – Pesticides in the Nation's Streams and Ground Water. 1992-2001. USGS Survey Circular 1291. Reston, Virginia.

_____. **2007.** Oil and Gas Exploration and Production in the United States Shown as Quarter-Mile Cells. Central Energy Resources Team. Denver, Colorado.

_____. **2012.** National Water Quality Assessment (NAWQA) Program. Groundwater Quality Trends. Available at: http://water.usgs.gov/nawqa/studies/gwtrends/

_____. **2013.** Groundwater Use in the United States. Available at: http://ga.water.usgs.gov/edu/wugw.html.

U.S. National Library of Medicine. 2006. Hazardous Substance Data Bank. Rimsulfuron. CASRN: 122931-48-0. Available at http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB.

_____. **2011.** Hazardous Substances Data Bank (HSDB). Fluroxypyr. CASRN 69377-81-7. Available at: http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB.

_____. **2012.** Hazardous Substance Data Bank. Aminopyralid. CASRN 150114-71-9. Available at: http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB

Utah State University. 2014. Spotted Knapweed. The Great Basin and Invasive Weeds. Available at: http://www.usu.edu/weeds/plant_species/weedspecies/spottedknap.html.

Wallace, J.M., T.S. Prather, and V. Peterson. 2012. Effects of Aminopyralid on Ponderosa Pine (*Pinus ponderosa*). Invasive Plant Science and Management 5(2):164-169.

Washington State University Extension. 2011. Herbicide Contamination of Organic Matter. Available at: http://whatcom.wsu.edu/ag/aminopyralid/.

Weir, J.R., T.G. Bidwell, R.D. Elmore, K.R. Hickman, S.D. Fuhlendorf, and D.M. Engle. 2004. Weed Control on Rangelands. Oklahoma Cooperative Extension Service Publication NREM-2882.

Wild, A. 1993. Soils and the Environment. First Edition. Cambridge University Press. Cambridge, Massachusetts.

Yoder, R., and K. Smith. 2002. Aerobic Soil Degradation of XDE-750 in Five North American Soils. Project Number: 010091 Unpublished Study Prepared by Dow AgroSciences LLC. MRID No. 46235729.

Zhang, J., G.B. Kyser, R. Wilson, E. Creech, and J. DiTomaso. 2010. Control of Downy Brome (*Bromus tectorum*) and Medusahead (*Taeniatherum caput-medusae*) with Rangeland Herbicides in Northeastern California. Available at: http://sfc.smallfarmcentral.com/dynamic_content/uploadfiles/152/DownyBrome_Medusahead_Control_.pdf

Zhang, S., C. Bin Qui, Y. Zhou, Z. Peng Jin, and H. Yang. 2011. Bioaccumulation and Degradation of the Pesticide Fluroxypyr are Associated with Toxic Tolerance in Green Alga *Chlamydomonas reinhardtii*. Ecotoxicology 20:337:347.

CHAPTER 7

GLOSSARY

CHAPTER 7

GLOSSARY

A

Absorption: The process by which a chemical or other substance is able to pass through body membranes and enter an organism.

Active ingredient (a.i.): The chemical or biological component that kills or controls the target pest.

Acute risk: Risk associated with illness or injury shortly after exposure to a potentially toxic substance.

Acute toxicity: The quality or potential of a substance to cause injury or illness shortly after exposure to a relatively large dose.

Adaptive management: A system of management practices based on clearly identified outcomes, monitoring to determine if management actions are meeting outcomes, and if not, facilitating management changes that will best ensure that outcomes are met or reevaluated.

Additive: A substance added to another in relatively small amounts to impart or improve desirable properties or suppress undesirable properties.

Additive effect: A situation in which combined effects of exposure to two chemicals simultaneously is equal to the sum of the effect of exposure to each chemical given alone.

Adjuvant: A chemical that is added to a pesticide by the user to improve the pesticide's efficacy. Adjuvants are often included in the pesticide formulation, becoming part of the inert, or other, ingredients associated with the formulation.

Adsorption: 1) The adhesion of substances to the surface of solids or liquids. 2) The attraction of ions of compounds to the surface of solids or liquids.

Adverse impact: An impact that causes harm or a negative result.

Aerobic: Utilizing oxygen or having oxygen present.

Aggregate Risk Index (ARI): a numeric expression of risk that combines potential risks from various exposure pathways. Used in the Human Health Risk Assessment.

Air pollutant: Any substance in the air that could, if present in high enough concentration, harm humans, animals, vegetation, or material. Air pollutants may include almost any natural or artificial matter capable of being airborne in the form of solid particles, liquid droplets, gases, or a combination of these.

Air quality: The composition of air with respect to quantities of pollution therein; used most frequently in connection with “standards” of maximum acceptable pollutant concentrations.

Alien (species): Per Executive Order 13112, alien species means, with respect to a particular ecosystem, any species, including its seed, eggs, spores, or other biological material capable of propagating that species, that is not native to that ecosystem.

Allotment (grazing): Area designated for the use of a certain number and kind of livestock for a prescribed period of time.

Alternative: In an EIS, one of a number of possible options for responding to the purpose and need for action.

Ambient air: Any unconfined portion of the atmosphere; open air and surrounding air. Often used interchangeably with “outdoor air.”

Anadromous: A term used to describe fish that mature in the sea and swim up freshwater rivers and streams to spawn. Salmon, steelhead, and sea-run cutthroat trout are examples.

Anaerobic: lacking in oxygen.

Animal Unit (AU): A standardized unit of measurement for range livestock that is equivalent to

one cow, one horse, five sheep, five goats, or four reindeer, all over 6 months of age.

Animal Unit Month (AUM): The amount of feed or forage required by one animal unit grazing on a pasture for 1 month.

Annual (plant): A plant whose life cycle is completed in 1 year or season.

Aquatic: Growing, living in, frequenting, or taking place in water; used to indicate habitat, vegetation, or wildlife in freshwater.

Aquifer: Rock or rock formations (often sand, gravel, sandstone, or limestone) that contain or carry groundwater and act as water reservoirs.

Area of Critical Environmental Concern (ACEC): An area within public lands that requires special management attention to protect and prevent irreparable damage to important historic, cultural, or scenic values; fish and wildlife resources; other natural systems or processes; or to protect life or provide safety from natural hazards.

Arid: A term applied to regions or climates where lack of moisture severely limits growth and production of vegetation. The limits of precipitation vary considerably according to temperature conditions.

Attainment area: A geographic area that is in compliance with the National Ambient Air Quality Standards. An area considered to have air quality as good as or better than the National Ambient Air Quality Standards as defined in the Clean Air Act.

B

Bioaccumulate: To take in or store a persistent substance, as by a plant or animal. Over time, a higher concentration of the substance is found in the organism than in the organism's environment.

Biodegradation: The process by which a substance is broken down by microorganisms and/or natural environmental factors.

Biodiversity: The variety of life and its processes, including all life forms from one-celled organisms to complex organisms such as insects, plants, birds, reptiles, fish, other animals; and the processes, pathways, and cycles that link such organisms into natural communities.

Biological Assessment (BA): A document prepared by or under the direction of a federal agency. A BA addresses federally listed species and species proposed for listing and designated and proposed critical habitat that may be present in the action area, and evaluates the potential effects of the action on such species and habitat.

Biological crust: Thin crust of living organisms on or just below the soil surface; composed of lichens, mosses, algae, fungi, cyanobacteria, and bacteria.

Boom (herbicide spray): A tubular metal device that conducts an herbicide mixture from a tank to a series of spray nozzles. It may be mounted beneath a helicopter or a fixed-wing aircraft, or behind a tractor or all-terrain vehicle.

Broadcast spray: An application of an herbicide that uniformly covers an entire area.

Broad-scale: At the level of a large, regional area, such as a river basin; typically a multi-state area.

Buffer/Buffer zone: A strip of vegetation that is left or managed to reduce the impact that a treatment or action on one area might have on another area.

Bunchgrass: A grass having the characteristic growth habit of forming a bunch; lacking stolons or rhizomes.

C

California Puff (CALPUFF): CALPUFF is an advanced non-steady-state meteorological and air quality modeling system adopted by the U.S. Environmental Protection Agency as the preferred model for assessing long range transport of pollutants and their impacts involving complex meteorological conditions.

Carbon-14 dating: The use of the naturally occurring isotope of carbon-14 in radiometric dating to determine the age of organic materials.

Carcinogen: A chemical capable of inducing cancer.

Carnivore: An animal that feeds on other animals, especially the flesh-eating mammals.

Carrier: A non-pesticidal substance added to a commercial pesticide formulation to make it easier to handle or apply.

Carrying capacity: The maximum population of a particular species that a particular region can support without hindering future generations' ability to maintain the same population.

Chemical degradation: The breakdown of a chemical substance into simpler components through chemical reactions.

Chronic exposure: Exposures that extend over the average lifetime or for a significant fraction of the lifetime of the individual. Chronic exposure studies are used to evaluate the carcinogenic potential of chemicals and other long-term health effects.

Chronic risk: Risk associated with long-term health effects after exposure to a potentially toxic substance. Symptoms recur frequently or develop slowly over a long period of time.

Class I area: Under the 1977 Clean Air Act amendments, all international parks, parks larger than 6,000 acres, and national wilderness areas larger than 5,000 acres that existed on August 7, 1977. This class provides the most protection to pristine lands by severely limiting the amount of additional air pollution that can be added to these areas.

Climate: The composite or generally prevailing weather conditions of a region throughout the year, averaged over a series of years.

Code of Federal Regulations (CFR): A codification of the general and permanent rules published in the Federal Register by the executive departments and agencies of the federal government.

Consultation: Exchange of information and interactive discussion; when the "C" in consultation is capitalized it refers to consultation mandated by statute or regulation that has prescribed parties, procedures, and timelines (e.g. Consultation under National Environmental Policy Act or Section 7 of the Endangered Species Act).

Coos Bay Wagon Road Lands: Public lands in Western Oregon that were granted to the State of Oregon, and then to the Coos Bay Wagon Road Company, to aid in the construction of a military wagon road from Coos Bay to Roseburg, Oregon. These lands were later reconveyed to the federal government by Congress.

Council on Environmental Quality (CEQ): An advisory council to the President of the United States established by the National Environmental Policy Act of 1969. It reviews federal programs for their effect on the environment, conducts environmental studies, and advises the President on environmental matters.

Countervailing: A type of cumulative impact where negative effects are compensated for by beneficial effects.

Cover: 1) Trees, shrubs, rocks, or other landscape features that allow an animal to partly or fully conceal itself. 2) The area of ground covered by plants of one or more species, usually expressed as a percent of the ground surface.

Criteria: Data and information that are used to examine or establish the relative degrees of desirability of alternatives or the degree to which a course of action meets an intended objective.

Criteria pollutants: Air pollutants designated by the U.S. Environmental Protection Agency as potentially harmful and for which ambient air quality standards have been set to protect the public health and welfare. The criteria pollutants are carbon monoxide, sulfur dioxide, particulate matter, nitrogen dioxide, ozone, hydrocarbons, and lead.

Critical habitat: 1) Specific areas within the habitat a species occupies at the time it is listed under the Endangered Species Act that have physical or biological features (a) that are essential to the conservation of the species and (b) that may require special management considerations or protection; and 2) specific areas outside the habitat a species occupies at the time it is listed that the Secretary of the Interior determines are essential for species conservation.

Cultural resources: Archaeological, historic, or architectural sites, structures, or places with important public or scientific uses, which may include definite locations (sites or places) of traditional cultural or religious importance to specific social or cultural groups.

Cumulative effects: Impacts on the environment that result from the incremental impact of an action when

added to other past, present, and reasonably foreseeable future actions. Cumulative effects can result from individually minor, but collectively significant, actions taking place over a period of time.

D

Degradate: The chemical compound resulting from a physical or biological breakdown of a more complex chemical compound.

Degradation: Physical or biological breakdown of a complex compound into simpler compounds.

Density: The number of individuals per a given unit area.

Direct effects: Impacts on the environment that are caused by the action and occur at the same time and place.

Dispersion: The act of distributing or separating into lower concentrations or less dense units.

Disturbance: Refers to events that alter the structure, composition, or function of terrestrial or aquatic habitats. Natural disturbances include, among others, drought, floods, wind, fires, wildlife grazing, and insects and pathogens. Human-caused disturbances include actions such as timber harvest, livestock grazing, roads, and the introduction of exotic species.

Dominant: A group of plants that by their collective size, mass, or number exerts a primary influence onto other ecosystem components.

Dose: The amount of chemical administered or received by an organism, generally at a given point in time.

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.

Draft Environmental Impact Statement (DEIS): The draft statement of the environmental effects of a major federal action which is required under Section 102 of the National Environmental Policy Act, and released to the public and other agencies for comment and review.

Drift: That part of a sprayed chemical that is moved by wind off a target site.

E

Ecoregion: Geographic areas that are delineated and defined by similar climatic conditions, geomorphology, and soils.

Ecosystem: Includes all the organisms of an area, their environment, and the linkages or interactions among all of them; all parts of an ecosystem are interrelated. The fundamental unit in ecology, containing both organisms and abiotic environments, each influencing the properties of the other and both necessary for the maintenance of life.

Ecosystem-based Management: Scientific knowledge of ecological relationships within a complex sociopolitical and values framework, that works toward a goal of protecting native ecosystem integrity over the long term.

Ecotone: A boundary or zone of transition between adjacent communities or environments, such as the boundary between a forest and a meadow. Species present in an ecotone are intermixed subsets of the adjacent communities.

Edge: The boundary zone or ecotone between two communities, both of which affect the composition and density of populations in these bordering areas.

Effect: Environmental change resulting from a proposed action. Direct effects are caused by the action and occur at the same time and place, while indirect effects are caused by the action but are later in time or further removed in distance, although still reasonably foreseeable. Indirect effects may include growth-inducing effects and other effects related to induced changes in the pattern of land use, population density, or growth rate, and related effects on air and water and other natural systems, including ecosystems. Effect and impact are synonymous as used in this document.

Endangered species: Plant or animal species that are in danger of extinction throughout all or a significant part of their range.

Endemic (species): Occurring naturally in a certain region and having a distribution that is relatively limited to a particular locality.

Environment: 1) The physical conditions that exist within an area (e.g., the area that will be affected by a proposed project), including land, air, water, minerals, flora, fauna, ambient noise, and objects of historical or aesthetic significance. 2) The sum of all external conditions that affect an organism or community to influence its development or existence.

Environmental Assessment (EA): A concise public document, for which a federal agency is responsible, that serves to: 1) briefly provide sufficient evidence and analysis for determining whether to prepare an environmental impact statement or a finding of no significant impact; 2) aid an agency's compliance with the National Environmental Policy Act when no environmental impact statement is necessary; and 3) facilitate preparation of an environmental impact statement when one is necessary.

Environmental Impact Statement (EIS): A required report for all federal actions that will lead to significant effects on the quality of the human environment. The report must be systematic and interdisciplinary, integrating the natural and social sciences as well as design in planning and decision-making. The report must identify 1) the environmental impacts of the proposed action, 2) any adverse environmental effects which cannot be avoided should the proposal be implemented, 3) alternatives to the proposed action, 4) the relationship between short-term uses of the human environment and the maintenance and enhancement of long-term productivity, and 5) any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented.

Environmental Justice: The fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.

Eradicate: To remove all traces of a population or elimination of a population to the point where individuals are no longer detectable.

Erosion: The wearing away of the land surface by running water, wind, ice, gravity, or other geological activities; can be accelerated or intensified by human activities that reduce the stability of slopes or soils.

Essential Fish Habitat: As defined by Congress in the interim final rule (62FR 66551): "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." For the purpose of interpreting the definition of Essential Fish Habitat, "waters" include aquatic areas and their associated physical, chemical, and biological properties; "substrate" includes sediment underlying the waters; "necessary" refers to the habitat required to support a sustainable fishery and the managed species contribution to a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" covers all habitat types utilized by a species throughout its life cycle.

Evapotranspiration: The sum of evaporation from the land surface plus water loss from plants during transpiration.

Exotic: Introduced into an area. Exotic species may adapt to the area into which they are introduced and compete with resident native (indigenous) species.

F

°F: Degrees Fahrenheit.

Fate: The course of a substance in an ecosystem or biological system, including metabolism, microbial degradation, leaching, and photodecomposition.

Fauna: The vertebrate and invertebrate animals of the area or region.

Feasible: Capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, legal, social, and technological factors.

Final Environmental Impact Statement (Final EIS): A revision of the Draft Environmental Impact Statement based on public and agency comments on the draft.

Fire dependent: An ecosystem evolving under periodic perturbations by fire and that consequently depends on periodic fires for normal ecosystem function.

Fire tolerant: Able to withstand fire at a certain frequency and intensity.

First (1st) order dermal absorption: Absorption of a material (herbicide) that occurs over 24 hours, taking into consideration the potential for some herbicide to not be absorbed.

Fisheries habitat: Streams, lakes, and reservoirs that support fish populations.

Fishery: The act, process, occupation, or season of taking an aquatic species.

Forage: Vegetation eaten by animals, especially grazing and browsing animals.

Forbs: Broad-leafed plants; includes plants that commonly are called weeds or wildflowers.

Forestland: Land where the potential natural plant community contains 10 percent or more tree canopy cover.

Formulation: The commercial mixture of both active and inactive (inert) ingredients.

Fossilization: The process of fossilizing a plant or animal that existed in some earlier age; the process of being turned to stone.

Fragmentation (habitat): The breaking-up of a habitat or cover type into smaller, disconnected parcels.

Fuel (fire): Dry, dead parts of trees, shrubs, and other vegetation that can burn readily.

G

Greenhouse Gas: Any gas that absorbs infrared radiation within the atmosphere. These gases prevent heat from escaping the atmosphere and regulate the Earth's temperature.

Groundwater: Subsurface water that is in the zone of saturation. The top surface of the groundwater is the "water table." Source of water for wells, seeps, and springs.

H

Habitat: The natural environment of a plant or animal, including all biotic, climatic, and soil conditions, or other environmental influences affecting living conditions. The place where an organism lives.

Half-life: The amount of time required for half of a compound to degrade.

Hazardous fuels: Includes living and dead and decaying vegetation that form a special threat of ignition and resistance to control.

Herbaceous: Non-woody plants that include grasses, grass-like plants, and forbs.

Herbicide: A chemical pesticide used to control, suppress, or kill vegetation, or severely interrupt normal growth processes.

Herbicide resistance: Naturally-occurring heritable characteristics that allow individual weeds to survive and reproduce, producing a population, over time, in which the majority of the plants of the weed species have the resistant characteristics.

Herbivore: An animal that feeds on plants.

Herd Management Areas (HMAs): Areas established for wild and free-roaming horses and burros through the land use planning process. The Wild Free-roaming Horse and Burro Act of 1971 requires that wild free-roaming horses and burros be considered for management where they were found at the time Congress passed the Act.

Home range: The area around an animal's established home that is visited during the animal's normal activities.

Hydrologic cycle (water cycle): The ecological cycle that moves water from the air by precipitation to the earth and returns it to the atmosphere; includes evaporation, run-off, infiltration, percolation, storage, and transpiration.

Hydrologic Region: The highest level hydrologic unit classification. Hydrologic regions are geographic areas that contain either the drainage of a major river or the combined drainage areas of a series of rivers.

Hydrolysis: Decomposition or alteration of a chemical substance by water.

I

Impermeable: Cannot be penetrated.

Indirect effects: Impacts that are caused by an action, but are later in time or farther removed in distance, although still reasonably foreseeable.

Inert (other) ingredient: Any substance, or ingredient, which is added to the commercial product (formulation), aside from the active ingredient.

Infestation: 1) The occurrence of one or more pest species in an area or location where their numbers and impacts are currently or potentially at intolerable levels. 2) A sudden increase in destructiveness or population numbers of a pest species in a given area.

Infiltration: The movement of water through soil pores and spaces.

Insectivore: An organism that feeds mainly on insects.

Integrated pest management (IPM): A long-standing, science-based, decision-making process that identifies and reduces risks from pests and pest management related strategies. It coordinates the use of pest biology, environmental information, and available technology to prevent unacceptable levels of pest damage by the most economical means, while posing the least possible risk to people, property, resources, and the environment. IPM provides an effective strategy for managing pests in all arenas from developed agricultural, residential, and public areas to wild lands. IPM serves as an umbrella to provide an effective, all encompassing, low-risk approach to protect resources and people from pests. BLM Handbook H-1740-2 (*Integrated Vegetation Management*) defines integrated pest management as "a sustainable approach to managing pests by combining biological, cultural, physical, and chemical tools in a way that minimizes economic, health, and environmental risks."

Integrated Vegetation Management (IVM): A system of controlling undesirable vegetation in which 1) undesirable vegetation within an ecosystem is identified and action thresholds are considered, and 2) all possible control options are evaluated and selected controls are implemented. Control options, which include biological, chemical, cultural, manual, and mechanical methods, are used to prevent or remedy unacceptable, unreliable, or unsafe conditions. Choice of control option(s) is based on effectiveness, environmental impact, site characteristics, worker/public health and safety, security, and economics. The goal of an IVM system is to manage vegetation and the environment to balance benefits of control, costs, public health, environmental quality, and regulatory compliance.

Integrated Weed Management (IWM): A sustainable approach for managing noxious weeds and other undesirable plants that combines biological, cultural, physical, and chemical tools in a way that minimizes economic, health, and environmental risks. IWM involves the use of several control techniques in a well-planned, coordinated, and organized program. It includes two phases: 1) inventory and, 2) planning and implementation.

Invasive plants: Plants that 1) are not part of (if exotic), or are a minor component of (if native), the original plant community or communities; 2) have the potential to become a dominant or co-dominant species on the site if their future establishment and growth is not actively controlled by management interventions; or 3) are classified as exotic or noxious plants under state or federal law. Species that become dominant for only one to several years (e.g. short-term response to drought or wildfire) are not invasive plants.

Invasive species: Per Executive Order 13112, an invasive species means an alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health.

Invertebrate: Small animals that lack a backbone or spinal column. Spiders, insects, and worms are examples of invertebrates.

Irretrievable commitment: A term that applies to losses of production or commitment of renewable natural resources. For example, while an area is used as a ski area, some or all of the timber production there is "irretrievably" lost. If the ski area closes, timber production could resume; therefore, the loss of timber production during the time the area is devoted to skiing is irretrievable, but not irreversible, because it is possible for timber production to resume if the area is no longer used as a ski area.

Irreversible commitment: A term that applies to non-renewable resources, such as minerals and archaeological sites. Losses of these resources cannot be reversed. Irreversible effects can also refer to the effects of actions on resources that can be renewed only after a very long period of time, such as the loss of soil productivity.

Issue: A matter of controversy, dispute, or general concern over resource management activities or land uses.

J

K

K_{oc}: Soil organic carbon-water partition coefficient. The ratio of the mass of a chemical that is adsorbed in the soil per unit of mass of organic carbon in the soil per the equilibrium chemical concentration in solution.

L

Land management: The intentional process of planning, organizing, programming, coordinating, directing, and controlling land use actions.

Landscape: All the natural features such as grasslands, hills, forest, and water, which distinguish one part of the earth's surface from another part; usually that portion of land that the eye can comprehend in a single view, including all of its natural characteristics.

Large woody debris: Pieces of wood that are of a large enough size to affect stream channel morphology.

LD_{50} (median lethal dose): 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.

Leaching: Usually refers to the movement of chemicals through the soil by water; may also refer to the movement of herbicides out of leaves, stems, or roots into the air or soil.

Level of concern (LOC): The concentration in media or some other estimate of exposure above which there may be effects.

Lichens: Organisms made up of specific algae and fungi, forming identifiable crusts on soil, rocks, tree, bark, and other surfaces. Lichens are primary producers in ecosystems. They contribute living material and nutrients, enrich the soil and increase soil moisture-holding capacity, and serve as food sources for certain animals. Lichens are slow growing and sensitive to chemical and physical disturbances.

Lifeways: The manner and means by which a group of people lives; their way of life. Components include language(s), subsistence strategies, religion, economic structure, physical mannerisms, and shared attitudes.

Litter: The uppermost layer of organic debris on the soil surface, which is essentially the freshly fallen or slightly decomposed vegetation material such as stems, leaves, twigs, and fruits.

Long term: Generally refers to a period longer than 10 years.

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.

M

Macrogroup: In the National Vegetation Classification Standard, a middle-level vegetation classification based on plant physiognomy, biogeography, and floristics.

Material safety data sheet (MSDS): A compilation of information required under the Occupational Safety and Health Administration Communication Standard on the identity of hazardous chemicals, health and physical hazards, exposure limits, and precautions.

Microbial degradation: The breakdown of a chemical substance into simpler components by bacteria or other microorganisms.

Microbiotic crust: See biological crust.

Minimize: Apply best available technology, management practices, and scientific knowledge to reduce the magnitude, extent, and/or duration of impacts.

Minimum tool (rule): Apply only the minimum-impact policy, device, force, regulation, instrument, or practice to bring about a desired result.

Mitigation: Steps taken to: 1) avoid an impact altogether by not taking a certain action or parts of an action; 2) minimize an impact by limiting the degree or magnitude of the action and its implementation; 3) rectify an impact by repairing, rehabilitating, or restoring the affected environment; 4) reduce or eliminate an impact over time by preserving and maintaining operations during the life of the action; and, 5) compensate for an impact by replacing or providing substitute resources or environments (40 CFR Part 1508.20).

Mitigation measures: Actions taken to avoid, compensate for, rectify, or reduce the potential adverse impact of an action.

Monitoring: The orderly collection, analysis, and interpretation of resource data to evaluate progress toward meeting management objectives.

Multiple uses: A combination of balanced and diverse resource uses that takes into account the long-term needs of future generations for renewable and nonrenewable resources. These may include recreation, range, timber, minerals, watershed, wildlife, and fish, along with natural scenic, scientific, and historical values.

N

National Ambient Air Quality Standards (NAAQS): Standards set by the U.S. Environmental Protection Agency for the maximum levels of pollutants that can exist in the outdoor air without unacceptable effects on human health or the public welfare.

National Back Country Byways: A program developed by the BLM to complement the National Scenic Byway program. The BLM's Byways show enthusiasts the best the West has to offer—from waterfalls to geology sculpted by volcanoes, glaciers, and rivers. Back Country Byways vary from narrow, graded roads, passable only during a few months of the year, to two-lane paved highways providing year-round access.

National Conservation Areas: Areas designated by Congress so that present and future generations of Americans can benefit from the conservation, protection, enhancement, use, and management of these areas by enjoying their natural, recreational, cultural, wildlife, aquatic, archeological, paleontological, historical, educational, and/or scientific resources and values.

National Environmental Policy Act (NEPA): An act of Congress passed in 1969, declaring a national policy to encourage productive and enjoyable harmony between people and the environment, to promote efforts that will prevent or eliminate damage to the environment and the biosphere and stimulate the health and welfare of people, and to enrich the understanding of the ecological systems and natural resources important to the nation, among other purposes.

National Historic Trails: Trails established to identify and protect historic routes; they follow as closely as possible the original trails or routes of travel of national historic significance.

National Landscape Conservation System (NLCS): A single system that encompasses some of the BLM's premier land designations. By putting these lands into an organized system, the BLM hopes to increase public awareness of these areas' scientific, cultural, educational, ecological, and other values.

National Monument: An area designated to protect objects of scientific and historic interest by public proclamation of the President under the Antiquities Act of 1906, or by the Congress for historic landmarks, historic and prehistoric structures, or other objects of historic or scientific interest situated upon the public lands; designation also provides for the management of these features and values.

National Recreation Area: An area designated by Congress to assure the conservation and protection of natural, scenic, historic, pastoral, and fish and wildlife values and to provide for the enhancement of recreational values.

National Recreation Trails: Trails established administratively by the Secretary of the Interior to provide for a variety of outdoor recreation uses in or

reasonably close to urban areas. They often serve as connecting links between the National Historic Trails and National Scenic Trails.

National Scenic Areas: Refers to the one national scenic area managed by the BLM: The Santa Rosa Mountains National Scenic Area in California, which encompasses approximately 101,000 acres. This area was designated by the Secretary of the Interior in 1990 to provide for the conservation, protection, and enhancement of scenic, recreation, and pastoral values.

National Scenic Trails: Trails established by an Act of Congress that are intended to provide for maximum outdoor recreation potential and for the conservation and enjoyment of nationally significant scenic, historical, natural, and cultural qualities of the areas through which these trails pass. National Scenic Trails may be located to represent desert, marsh, grassland, mountain, canyon, river, forest, and other areas, as well as land forms that exhibit significant characteristics of the physiographic regions of the nation.

National Wild and Scenic Rivers: Rivers designated in the National Wild and Scenic Rivers System that are classified in one of three categories, depending on the extent of development and accessibility along each section. In addition to being free flowing, these rivers and their immediate environments must possess at least one outstandingly remarkable value: scenic, recreational, geologic, fish and wildlife, historical, cultural, or other similar values.

Native species: Species that historically occurred or currently occur in a particular ecosystem and were not introduced.

Natural community: An assemblage of organisms indigenous to an area that is characterized by distinct combinations of species occupying a common ecological zone and interacting with one another.

Natural resources: Water, soil, plants and animals, nutrients, and other resources produced by the earth's natural processes.

Neurotoxic: Affecting nerve cells and possibly produce muscular, emotional, or behavioral abnormalities, impaired or abnormal motion, and other physiologic changes.

No action alternative: The most likely condition to exist in the future if current management direction were to continue unchanged.

No observed adverse effect level (NOAEL): The 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.

Non-selective herbicide: An herbicide that is generally toxic to plants without regard to species.

Non-target: Any plant, animal, or organism that a method of application is not aimed at, but may accidentally be injured by the application.

Noxious weed: Any plant designated by a federal, state, or county government, or other governing body, as injurious to public health, agriculture, recreation, wildlife, or property.

Nutrient cycling: The circulation of nutrients and elements such as carbon, phosphorous, nitrogen, and others, among animals, plants, soils, and air.

O

Objective: A concise, time-specific statement of measurable planned results that respond to pre-established goals. An objective forms the basis for further planning to define the precise steps to be taken and the resources to be used to achieve identified goals.

Omnivore: An animal that eats a combination of meat and vegetation.

Oregon and California grant lands: Public lands in Western Oregon that were granted to the Oregon Central Railroad companies (later the Oregon and California Railroad Company) to aid in the construction of railroads, but that were later forfeited and returned to the federal government by revestment of title.

Overgrazing: Continued heavy grazing which exceeds the recovery capacity of the plant community and creates a deteriorated rangeland.

Overstory: The upper canopy layer.

P

Paleontological resources: A work of nature consisting of or containing evidence of extinct multicellular beings. Includes those works or classes of works of nature designated by the regulations as paleontological resources.

Paleontology: A science dealing with the life of past geological periods as known from fossil remains.

Particulate matter (PM): A complex mixture consisting of varying combinations of dry solid fragments, solid cores with liquid coatings, and small droplets of liquid. These tiny particles vary greatly in shape, size and chemical composition, and can be made up of many different materials such as metals, soot, soil, and dust.

Particulates: Solid particles or liquid droplets suspended or carried in the air.

Pathogen: An agent such as a fungus, virus, or bacterium that causes disease.

Payments in lieu of taxes: Payments made to counties by the BLM to mitigate for losses to counties because public lands cannot be taxed.

Per capita income: Total income divided by the total population.

Perennial: A plant that lives for 2 or more years.

Permit: A revocable authorization to use public land for a specified purpose.

Persistence: Refers to the length of time a compound, once introduced into the environment, stays there.

Petroglyph: An image recorded on stone, usually by prehistoric peoples, by means of carving, pecking, or otherwise incised on natural rock surfaces.

Pictograph: A symbol that represents an object or a concept by illustration.

pH: A measure of how acidic or alkaline (basic) a solution is on a scale of 0 to 14 with 0 being very acidic, 14 being very alkaline, and 7 being neutral. The abbreviation stands for the potential of hydrogen.

Photodegradation: The photochemical transformation of a molecule into lower molecular weight fragments, usually in an oxidation process. This term is widely used in the destruction (oxidation) of pollutants by ultraviolet-based processes.

Photolysis: Chemical decomposition induced by light or other radiant energy.

Phytotoxicity: The ability of a material such as a pesticide or fertilizer to cause injury to plants.

Plant community: A vegetation complex, unique in its combination of plants, which occurs in particular locations under particular influences. A plant community is a reflection of integrated environmental influences on the site, such as soils, temperature, elevation, solar radiation, slope aspect, and precipitation.

$PM_{2.5}$: Fine particulates that measure 2.5 microns in diameter or less.

PM_{10}: Particulate matter that measures 10 microns in diameter or less.

Porosity: The ratio of the volume of void space in a material (e.g., sedimentary rock or sediments) to the volume of its mass.

Predator: An organism that captures and feeds on parts or all of a living organism of another species.

Preferred alternative: The alternative identified in an EIS that has been selected by the agency as the most acceptable resolution to the problems identified in the purpose and need.

Prescribed fire: A management ignited wildland fire that burns under specified conditions and in a predetermined area, and that produces the fire behavior and fire characteristics required to attain fire treatment and resource management objectives.

Prevention of Significant Deterioration (PSD): A U.S. Environmental Protection Agency program in which state and/or federal permits are required in order to restrict emissions from new or modified sources in places where air quality already meets or exceeds primary and secondary ambient air quality standards.

Productivity: The innate capacity of an environment to support plant and animal life over time. Plant

productivity is the rate of plant production within a given period of time. Soil productivity is the capacity of a soil to produce plant growth, due to the soil's chemical, physical, and biological properties.

Programmatic EIS: An area-wide EIS that provides an overview when a large-scale plan is being prepared for the management of federally administered lands on a regional or multi-regional basis.

Proper functioning condition: Riparian and wetland areas achieve proper functioning condition when adequate vegetation, landform, or large woody debris is present to dissipate stream energy associated with high water flows. This reduces erosion and improves water quality; filters sediment, captures bedload, and aids in floodplain development; improves floodwater retention and groundwater recharge; develops root masses that stabilize streambanks against cutting; develops diverse ponding and channel characteristics to provide habitat and water depth, duration, and temperature necessary for fish production, avian breeding habitat, and other uses; and supports greater biodiversity.

Proposed action: A proposal by a federal agency to authorize, recommend, or implement an action.

Public lands: Any land and interest in land owned by the United States that are administered by the Secretary of the Interior through the BLM, without regard to how the United States acquired ownership, except for 1) lands located on the Outer Continental Shelf, and 2) lands held for the benefit of Indians, Aleuts, and Eskimos. Includes public domain and acquired lands.

Public scoping: A process whereby the public is given the opportunity to provide oral or written comments about the influence of a project on an individual, the community, and/or the environment.

Q

Qualitative: Traits or characteristics that relate to quality and cannot be readily measured with numbers.

Quantitative: Traits or characteristics that can be measured with numbers.

R

Rangeland: Land on which the native vegetation is predominantly grasses, grass-like plants, forbs, or shrubs; not forests.

Raptor: Bird of prey; includes eagles, hawks, falcons, and owls.

Receptor: An ecological entity exposed to a stressor.

Record of Decision (ROD): A document separate from, but associated with, an EIS, which states the decision, identifies alternatives (specifying which were environmentally preferable), and states whether all practicable means to avoid environmental harm from the alternative have been adopted, and if not, why not.

Registered herbicide: All herbicides sold or distributed in the United States must be registered by the U.S. Environmental Protection Agency, based on scientific studies, showing that they can be used without posing unreasonable risks to people or the environment.

Research Natural Areas: Special management areas designated either by Congress or by a public or private agency to preserve and protect typical or unusual ecological communities, associations, phenomena, characteristics, or natural features or processes for scientific and educational purposes. They are established and managed to protect ecological processes, conserve biological diversity, and provide opportunities for observation for research and education.

Residue: The quantity of an herbicide or its metabolites remaining in or on soil, water, plants, animals, or surfaces.

Resource Management Plan: Comprehensive land management planning document prepared by and for the BLM's administered properties under requirements of the Federal Land Policy and Management Act. Bureau of Land Management lands in Alaska were exempted from this requirement.

Restoration: Actions taken to modify an ecosystem to achieve desired, healthy, and functioning conditions and processes.

Return interval (fire): The average time between fires in a given area.

Revegetation: Establishing or re-establishing desirable plants on areas where desirable plants are absent or of inadequate density, by management alone (natural revegetation) or by seeding or transplanting (artificial revegetation).

Rights-of-way (ROW): A permit or an easement that authorizes the use of lands for certain specified purposes, such as the construction of an access road or pipeline.

Riparian: Occurring adjacent to streams and rivers and directly influenced by water. A riparian community is characterized by certain types of vegetation, soils, hydrology, and fauna, and requires free or unbound water or conditions more moist than that normally found in the area.

Risk: The likelihood that a given exposure to an item or substance that presents a certain hazard will produce illness or injury.

Risk assessment: The process of gathering data and making assumptions to estimate short- and long-term harmful effects on human health or the environment from particular products or activities.

Risk Quotient (RQ): A value used in risk assessments to compare toxicity to environmental exposure. The risk quotient is calculated by dividing a point estimate of exposure by a point estimate of effects. The risk quotient is compared to the applicable Level of Concern to analyze potential risk to non-target organisms.

Runoff: That part of precipitation, as well as any other flow contributions, that appears in surface streams, either perennial or intermittent.

S

Salmonids: Fishes of the family Salmonidae, including salmon, trout, chars, whitefish, ciscoes, and grayling.

Scoping: The process by which significant issues relating to a proposal are identified for environmental analysis. Scoping includes eliciting public comment on the proposal, evaluating concerns, and developing alternatives for consideration.

Section 3: Lands administered under Section 3 of the Taylor Grazing Act. This section of the law provided for the lease of grazing district lands to landowners and homesteaders in or adjacent to the reserves first and issuance of 1 to 10 year leases.

Section 15: Lands administered under Section 15 of the Taylor Grazing Act. Under Section 15, public lands outside of grazing districts could be leased to ranchers with contiguous property.

Sediments: Unweathered geologic materials generally laid down by or within water bodies; the rocks, sand, mud, silt, and clay at the bottom and along the edge of lakes, streams, and oceans.

Sedimentation: The process of forming or depositing sediment; letting solids settle out of wastewater by gravity during treatment.

Selective herbicide: A chemical designed to affect only certain types of plants, leaving other plants unharmed.

Semi-arid: Moderately dry; region or climate where moisture is normally greater than under arid conditions, but still limits the production of vegetation.

Sensitive species: 1) Plant or animal species susceptible or vulnerable to activity impacts or habitat alterations. 2) Species that have appeared in the Federal Register as proposed for classification or are under consideration for official listing as endangered or threatened species.

Short-term impacts: Impacts occurring during project construction and operation, and normally ceasing upon project closure and reclamation. For each resource the definition of short-term may vary.

Significant: The description of an impact that exceeds a certain threshold level. Requires consideration of both context and intensity. The significance of an action must be analyzed in several contexts, such as society as a whole, and the affected region, interests, and locality. Intensity refers to the severity of impacts, which should weighted along with the likelihood of its occurrence.

Snag: A standing dead tree, usually larger than 5 feet tall and 6 inches in diameter at breast height.

Socioeconomic: Pertaining to, or signifying the combination or interaction of social and economic factors.

Soil compaction: The compression of the soil profile from surface pressure, resulting in reduced air space, lower water holding capacity, and decreased plant root penetrability.

Southern Nevada Public Land Management Act: Act that provides for the disposal of public land within a specific area in the Las Vegas Valley and creates a special account into which 85 percent of the revenue generated by land sales or exchanges in the Las Vegas Valley is deposited. The remaining 15 percent goes to state and local governments.

Special status species: Refers to federally listed threatened, endangered, proposed, or candidate species, and species managed as sensitive species by the BLM.

Spot treatment: An application of an herbicide to a small selected area as opposed to broadcast application.

Stand: A group of trees in a specific area that is sufficiently alike in composition, age, arrangement, and condition so as to be distinguishable from the forest in adjoining areas.

Standard Operating Procedures (SOPs): Procedures followed by the BLM to minimize risks to human health and the environment from treatment actions.

Step-down: Refers to the process of applying broad-scale science findings and land use decisions to site-specific areas using a hierarchical approach of understanding current resource conditions, risks, and opportunities.

Stressor: Any event or situation that precipitates a change.

Subchronic: The effects observed from doses that are of intermediate duration, usually 90 days.

Subsistence: Customary and traditional uses of wild renewable resources (plants and animals) for food, shelter, fuel, clothing, tools, etc.

Surfactant: A material that improves the emulsifying, dispersing, spreading, wetting, or other surface-modifying properties of liquids.

Surrogate: A substitute or stand-in.

Synergistic: A type of cumulative impact where total effect is greater than the sum of the effects taken independently.

T

Tank mixture: The mixture of two or more compatible herbicides in a spray tank in order to apply them simultaneously.

Target species: Plant species of competing vegetation that is controlled in favor of desired species.

Terrestrial: Of or relating to the earth, soil, or land; inhabiting the earth or land.

Threatened species: A plant or animal species likely to become an endangered species throughout all or a significant portion of its range within the foreseeable future.

Threshold: A level below which there is no apparent or measurable adverse effect.

Tier: In an EIS, refers to incorporating by reference the analyses in an EIS or similar document of a broader scope. For example, BLM field offices could prepare environmental assessments for local projects that tier to this PEIS.

Total suspended particles (TSP): A method of monitoring airborne particulate matter by total weight.

Toxicity: A characteristic of a substance that makes it poisonous.

Tribe: Term used to designate any Indian tribe, band, nation, or other organized group or community (including any Alaska Native village or regional or village corporation as defined in or established pursuant to the Alaska Native Claims Settlement Act) which is recognized as eligible for the special programs and services provided by the U.S. to Indians because of their status as Indians.

U

Understory: Plants that grow beneath the canopy of other plants. Usually refers to grasses, forbs, and low shrubs under a tree or shrub canopy.

Undesirable plants: Species classified as undesirable, noxious, harmful, exotic, injurious, or poisonous under state or federal law, but not including species listed as endangered by the Endangered Species Act, or species indigenous to the planning area.

Upland: The portion of the landscape above the valley floor or stream.

V

Vascular plants: Plants that have specialized tissues which conduct nutrients, water, and sugars along with other specialized parts such as roots, stems, and reproductive structures. Vascular plants include flowering plants, ferns, shrubs, grasses, and trees.

Visual resources: The visible physical features of a landscape.

Volatilization: The conversion of a solid or liquid into a gas or vapor.

W

Water quality: The interaction between various parameters that determines the usability or non-usability of water for on-site and downstream uses. Major parameters that affect water quality include temperature, turbidity, suspended sediment, conductivity, dissolved oxygen, pH, specific ions, discharge, and fecal coliform.

Watershed: The region draining into a river, river system, or body of water.

Weed: A plant considered undesirable and that interferes with management objectives for a given area at a given point in time.

Weed-free (feed/straw/mulch/other materials): Materials that have been inspected in the field of origin to determine that they are free of viable noxious weed seeds at the time of harvest. A weed-free certification is available at the state level.

Wetlands: Those areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstance do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands include habitats such as swamps, marshes, fens, and wet meadows.

Wilderness: Land designated by Congress as a component of the National Wilderness Preservation System. For an area to be considered for Wilderness designation it must be roadless and possess the characteristics required by Section 2(c) of the Wilderness Act of 1964. These characteristics are: 1) naturalness – lands that are natural and primarily affected by the forces of nature; 2) roadless and having at least 5,000 acres of contiguous public lands; and 3) outstanding opportunities for solitude or primitive and unconfined types of recreation. In addition, areas may contain "supplemental values," consisting of ecological, geological, or other features of scientific, educational, scenic, or historical importance.

Wildfire: Unplanned human or naturally caused fires in wildlands.

Wildland fires: Fires that occur on wildlands, regardless of ignition source, damages, or benefits, and include wildfire and prescribed fire.

Wildland Urban Interface (WUI): An area where structures and other human development intermingle with undeveloped wildlands or vegetative fuels.

Woodland: A forest in which the trees are often small, characteristically short-bolded relative to their crown depth, and forming only an open canopy with the intervening area being occupied by lower vegetation, commonly grass.

XYZ

CHAPTER 8

INDEX

CHAPTER 8

INDEX

Air Quality
Description: 3-2
Effects: 4-5
Scoping Comments and Other Issues Evaluated in the Assessment: 4-5
Methodology for Assessing Impacts to Air Quality: 4-5
Standard Operating Procedures: 4-6
Impacts by Alternative: 4-6
Mitigation: 4-9
Cumulative Effects: 4-103
Unavoidable Effects: 4-114
Short- and Long-term Effects: 4-116
Irreversible Effects: 4-119

Alternatives
Chapter 2 of the EIS is devoted to describing the alternatives
Chapter 4 is devoted to analyzing the effects of the No Action Alternative and alternatives B, C, and D
Development of Alternatives: 1-7
Description of the Alternatives: 2-2
Alternative A: 2-3
Alternative B: 2-4
Alternative C: 2-4
Alternative D: 2-7
Alternatives Considered but Not Analyzed Further: 2-7
Summary of Impacts by Alternatives: 2-10
See also Air Quality; Soil Resources; Water Resources and Quality; Wetland and Riparian Areas; Fish and Other Aquatic Organisms; Wildlife Resources; Livestock; Wild Horses and Burros; Paleontological and Cultural Resources; Visual Resources; Wilderness and Special Areas; Recreation; Social and Economic Values; and Human Health and Safety

American Indian and Alaska Native Cultural Resources
Alaska National Interest Conservation Lands (ANILCA) Section 810 Analysis of Subsistence Impacts: Appendix C
See Paleontological and Cultural Resources

Anadromous Fish
See Fish and Other Aquatic Organisms

Biological Soil Crust
See Soil Resources

Climate
Description: 3-2

Consultation and Coordination
Chapter 5 of the EIS is devoted to consultation and coordination
Description: 1-5
Coordination and Education: 2-9

Cumulative Effects
Structure of the Cumulative Effects Analysis: 4-102
Resource Protection Measures Considered in the Cumulative Effects Analysis: 4-103
Cumulative Effects by Resources: 4-103
Unavoidable Adverse Effects: 4-114
Short- and Long-term Effects: 4-116
Irreversible Effects: 4-119

Decisions to be Made
Decisions to be Made by Decisionmaker: 1-3

Demographic
See Social and Economic Values

Economic Environment
See Social and Economic Values

Ecoregions
Description: 3-1
Program Goals by Ecoregion: 4-4

Effects
Comparison of Alternatives: 2-11
How the Effects of the Alternatives Were Estimated: 4-1
Chapter 4 is devoted to analyzing the effects of the No Action Alternative and alternatives B, C, and D

Environment
Chapter 3 of the EIS is devoted to a description of the environment
Chapter 4 of the EIS is devoted to analysis of effects on the environment

European Settlement Resources
See Paleontological and Cultural Resources

Expenditures by the BLM
See Social and Economic Values

Fish and Other Aquatic Organisms
Description: 3-19
Special Status Species: 3-20
Effects: 4-41
Scoping Comments and Other Issues Evaluated in the Assessment: 4-41
Standard Operating Procedures: 4-41
Impacts Assessment Methodology: 4-42
Summary of Herbicide Impacts: 4-43
Impacts by Alternative: 4-46
Special Status Fish and Other Aquatic Organisms: 4-48
Mitigation: 4-46, 4-51
Cumulative Effects: 4-107
Unavoidable Effects: 4-115
Short- and Long-term Effects: 4-117
Irreversible Effects: 4-120

Fire
Vegetation Condition and Fire Regimes: 3-17

Greenhouse Gas Emissions
See Air Quality

Herbicides
Herbicide Active Ingredients Evaluated under the Proposed Alternatives: 2-1
Herbicide Formulations and Tank Mixes: 2-2
Herbicide Treatment Standard Operating Procedures: 2-7

Human Health and Safety
Description: 3-37
Effects: 4-85
Scoping Comments and Other Issues Evaluated in the Assessment: 4-85
Standard Operating Procedures: 4-86
Human Health Risks Associated with Herbicides: 4-88
Impacts by Alternative: 4-100
Mitigation: 4-102
Cumulative Effects: 4-113
Unavoidable Effects: 4-116
Short- and Long-term Effects: 4-119
Irreversible Effects: 4-121

Impacts
See Alternatives and Cumulative Effects

Important Plant Uses and Species Used by American Indians and Alaska Natives
See Paleontological and Cultural Resources

Issues and Concerns
Issues and Concerns (scoping): 1-6
Issues Not Addressed: 1-7

Land Use
Description: 3-1
Effects: 4-4

Livestock
Description: 3-21
Effects: 4-62
Scoping Comments and Other Issues Evaluated in the Assessment: 4-62
Standard Operating Procedures: 4-63
Impacts Assessment Methodology: 4-63
Summary of Herbicide Impacts: 4-63
Impacts by Alternative: 4-65
Mitigation: 4-66
Cumulative Effects: 4-109
Unavoidable Effects: 4-115
Short- and Long-term Effects: 4-117
Irreversible Effects: 4-120

Mitigation
Description: 2-9
See also Air Quality; Soil Resources; Water Resources and Quality; Wetland and Riparian Areas; Fish and Other Aquatic Organisms; Wildlife Resources; Livestock; Wild Horses and Burros; Paleontological and Cultural Resources; Visual Resources; Wilderness and Special Areas; Recreation; Social and Economic Values; and Human Health and Safety

Native Peoples
See Social and Economic Values; Paleontological and Cultural Resources; and Cumulative Effects

Non-timber Forest Products
Description: 3-19

Noxious Weeds and Other Invasive Vegetation
Description: 3-16

Paleontological and Cultural Resources
Description: 3-22
Effects: 4-70
Scoping Comments and Other Issues Evaluated the in Assessment: 4-70

Paleontological and Cultural Resources (cont.)
Effects (cont.)
Standard Operating Procedures for Addressing BLM Actions on Paleontological, Cultural, and Subsistence Resources: 4-70
Summary of Herbicide Impacts: 4-70
Herbicide Impacts on Native American Health: 4-71
Impacts by Alternative: 4-72
Mitigation: 4-73
Cumulative Effects: 4-110
Unavoidable Effects: 4-115
Short- and Long-term Effects: 4-118
Irreversible Effects: 4-120

Public Involvement
Public Scoping Meetings: 1-6
Public Involvement: 5-1

Purpose and Need for the Proposed Action
Proposed Action: 1-1
Purpose and Need: 1-2

Recreation
Description: 3-28
Effects: 4-78
Scoping Comments and Other Issues Evaluated in the Assessment: 4-78
Standard Operating Procedures: 4-79
Summary of Herbicide Impacts: 4-79
Impacts by Alternative: 4-79
Mitigation: 4-80
Cumulative Effects: 4-112
Unavoidable Effects: 4-116
Short- and Long-term Effects: 4-118
Irreversible Effects: 4-121

Revenues Generated by BLM Lands
See Social and Economic Values

Riparian Areas
See Wetlands and Riparian Areas

Rights-of-way
Description: 3-28

Risk from Cancer, Disease, Injuries, or Using Herbicides on Public Lands
See Human Health and Safety

Scoping
Scope of Analysis: 1-2
Public Involvement, Scoping, and Issues: 1-6, 5-1

Social and Economic Values
Description: 3-29
Effects: 4-80
Scoping Comments and Other Issues Evaluated in the Assessment: 4-80
Standard Operating Procedures: 4-82
Impact Assessment Assumptions: 4-81
Summary of Herbicide Impacts: 4-82
Impacts by Alternative: 4-83
Mitigation: 4-85
Cumulative Effects: 4-112
Unavoidable Effects: 4-116
Short- and Long-term Effects: 4-119
Irreversible Effects: 4-121

Soil Compaction
See Soil Resources

Soil Erosion
See Soil Resources

Soil Resources
Description: 3-6
Effects: 4-9
Scoping Comments and Other Issues Evaluated in the Assessment: 4-10
Standard Operating Procedures: 4-10
Factors that Influence the Fate, Transport, and Persistence of Herbicides in Soil: 4-10
Impacts by Alternative: 4-12
Mitigation: 4-14
Cumulative Effects: 4-104
Unavoidable Effects: 4-114
Short- and Long-term Effects: 4-116
Irreversible Effects: 4-119

Special Status Species
See Fish and Other Aquatic Resources
See Vegetation
See Wildlife Resources

Species
Common and Scientific Names of Species: Appendix A
Special Status Species List: Appendix E

Statues, Regulations, and Policies
Laws, Policies, and Regulations that Influence Vegetation Treatments: 1-3

Stipulations and Required Operating Procedures
Herbicide Treatment Standard Operating Procedures: 2-7

Stipulations and Required Operating Procedures (cont.)
Monitoring: 2-9
See also Air Quality; Soil Resources; Water Resources and Quality; Wetland and Riparian Areas; Fish and Other Aquatic Organisms; Wildlife Resources; Livestock; Wild Horses and Burros; Paleontological and Cultural Resources; Visual Resources; Wilderness and Special Areas; Recreation; Social and Economic Values; and Human Health and Safety

Threatened and Endangered Species
Consultation: Chapter 5
List of Special Status Species: Appendix E

Topography, Geology, Minerals, Oil, and Gas
Description: 3-6

Vegetation
Monitoring: 2-9
Description: 3-11
Special Status Species: 3-20
Effects: 4-24
- Scoping Comments and Other Issues Evaluated in the Assessment: 4-25
- Standard Operating Procedures: 4-25
- Impacts Assessment Methodology: 4-25
- Impacts of Herbicide Treatments: 4-26
- Impacts by Ecoregion: 4-32
- Impacts by Alternative: 4-35
- Special Status Plant Species: 4-37
- Mitigation: 4-37, 4-40
- Cumulative Effects: 4-106
- Unavoidable Effects: 4-115
- Short- and Long-term Effects: 4-117
- Irreversible Effects: 4-120

Vegetation Condition and Fire Regimes
Description: 3-17

Visual Resources
Description: 3-25
Effects: 4-74
- Scoping Comments and Other Issues Evaluated in the Assessment: 4-74
- Standard Operating Procedures: 4-74
- Summary of Herbicide Impacts: 4-75
- Impacts by Alternative: 4-75
- Mitigation: 4-76
- Cumulative Effects: 4-110
- Unavoidable Effects: 4-115
- Short- and Long-term Effects: 4-118
- Irreversible Effects: 4-121

Water Resources and Quality
Water Resources Description: 3-8
Water Quality Description: 3-9
Effects: 4-14
- Scoping Comments and Other Issues Evaluated in the Assessment: 4-14
- Standard Operating Procedures: 4-14
- Summary of Herbicide Impacts: 4-15
- Impacts by Alternative: 4-18
- Mitigation: 4-20
- Cumulative Effects: 4-105
- Unavoidable Effects: 4-114
- Short- and Long-term Effects: 4-117
- Irreversible Effects: 4-119

Wetland and Riparian Areas
Description: 3-10
Effects: 4-20
- Scoping Comments and Other Issues Evaluated in the Assessment: 4-20
- Factors that Influence the Fate, Transport, and Persistence of Herbicides in Wetlands and Riparian Areas: 4-20
- Summary of Herbicide Impacts: 4-21
- Impacts by Alternative: 4-23
- Mitigation: 4-24
- Cumulative Effects: 4-106
- Unavoidable Effects: 4-114
- Short- and Long-term Effects: 4-117
- Irreversible Effects: 4-120

Wild Horses and Burros
Description: 3-21
Effects: 4-66
- Scoping Comments and Other Issues Evaluated in the Assessment: 4-67
- Standard Operating Procedures: 4-67
- Impacts Assessment Methodology: 4-67
- Summary of Herbicide Impacts: 4-67
- Impacts by Alternative: 4-68
- Mitigation: 4-69
- Cumulative Effects: 4-109
- Unavoidable Effects: 4-115
- Short- and Long-term Effects: 4-117
- Irreversible Effects: 4-120

Wilderness and Other Special Areas
Description: 3-26
Effects: 4-76
- Scoping Comments and Other Issues Addressed in the Assessment: 4-76
- Standard Operating Procedures: 4-76
- Summary of Herbicide Impacts: 4-77

Wilderness and Special Areas (cont.)
Effects (cont.):
Impacts by Alternative: 4-77
Mitigation: 4-78
Cumulative Effects: 4-111
Unavoidable Effects: 4-115
Short- and Long-term Effects: 4-118
Irreversible Effects: 4-120
See also Recreation Resources
See also Visual Resources

Wildlife Resources
Description: 3-20
Special Status Species: 3-21
Effects: 4-51
Scoping Comments and Other Issues Evaluated in the Assessment: 4-51
Standard Operating Procedures: 4-52
Impacts Assessment Methodology: 4-52
Summary of Herbicide Impacts: 4-53
Impacts of Herbicide Treatments on Wildlife and Habitat by Ecoregion: 4-56
Impacts by Alternative: 4-58
Mitigation: 4-62
Special Status Wildlife Species: 4-59
Cumulative Effects: 4-108
Unavoidable Effects: 4-115
Short- and Long-term Effects: 4-117
Irreversible Effects: 4-120

APPENDIX A

COMMON AND SCIENTIFIC NAMES OF PLANTS AND ANIMALS GIVEN IN THE PROGRAMMATIC EIS

APPENDIX A

COMMON AND SCIENTIFIC NAMES OF PLANTS AND ANIMALS GIVEN IN THE PROGRAMMATIC EIS

This appendix contains a list of the common and scientific names of plant and animal species mentioned in the text of the PEIS. Naming conventions generally follow the USDA Natural Resources Conservation Service PLANTS Database (http://plants.usda.gov/java/), except in cases where a more widely used common name has been used for clarity.

Common Name	Scientific Name
PLANTS	
Grasses	
Bluegrass	*Poa* spp.
Bluegrass, Kentucky	*Poa pratensis*
Bluestem, big	*Andropogon gerardii*
Brome, field	*Bromus arvensis*
Brome, Japanese	*Bromus japonicus*
Brome, red	*Bromus rubens*
Brome, smooth	*Bromus inermis*
Brome, soft	*Bromus hordaceous*
Buffalograss	*Buchloe dactyloides*
Buffelgrass	*Pennisetum ciliare*
Canarygrass, reed	*Phalaris arundinacea*
Cheatgrass (downy brome)	*Bromus tectorum*
Fescue, Idaho	*Festuca idahoensis*
Grama, blue	*Bouteloua gracilis*
Grass, Mediterranean	*Schismus barbatus*
Needlegrass, green	*Nassella viridula*
Reed, common	*Phragmites australis*
Reed, giant	*Arundo donax*
Ricegrass, Indian	*Achnatherum hymenoides*
Rye, medusahead	*Taeniatherum caput-medusae*
Sweetgrass	*Hierochloe* spp.
Wheatgrass, bluebunch	*Pseudoroegneria spicata*
Wheatgrass, western	*Pascopyrum smithii*
Forbs and Nonvascular Plants	
Alfalfa	*Medicago* spp.
Algae, blue-green	*Cyanobacteria*
Algae, brown	*Phaeophyceae*
Algae, green	*Chlorophyta*
Cattail	*Typha* spp.
Cress, hoary	*Cardaria draba*
Ginseng	*Eleutherococcus pentaphyllus*
Goldenseal	*Hydrastis canadensis*
Halogeton	*Halogeton glomeratus*
Henbane, black	*Hyoscyamus niger*

Common Name	Scientific Name
PLANTS (Cont.)	
Knapweed	*Centaurea* spp.
Knapweed, diffuse	*Centaurea diffusa*
Knotweed, Japanese	*Polygonum cuspidatum*
Knapweed, Russian	*Acroptilon repens*
Knapweed, spotted	*Centaurea stoebe* or *Centaurea biebersteinii*
Knapweed, squarrose	*Centaurea virgata*
Kochia	*Kochia scoparia* or *Bassia scoparia*
Kochia, forage	*Bassia prostrata*
Liverworts	Members of the Marchantiopsida class
Loosestrife, purple	*Lythrum salicaria*
Marestail (horseweed)	*Conyza canadensis*
Moss	Various species
Mustard	*Brassicaceae*
Pepperweed, perennial	*Lepidium latifolium*
Plantain	*Plantago* spp.
Ragwort, tansy	*Senecio jacobaea*
Salvinia, giant	*Salvinia molesta* (*S. auriculata, S. biloba, S. herzogii*)
Skeletonweed, rush	*Chondrilla juncea*
Snakeweed	*Gutierrezia* spp.
Spurge, leafy	*Euphorbia esula*
Starthistle, Maltese	*Centaurea melitensis*
Starthistle, yellow	*Centaurea solstitialis*
Sweetclover	*Melilotus officinalis*
Thistle, bull	*Cirsium vulgare*
Thistle, Canada	*Cirsium arvense*
Thistle, Italian	*Carduus pycnocephalus*
Thistle, musk	*Carduus nutans*
Thistle, plumeless	*Carduus* spp.
Thistle, Russian	*Salsola kali*
Thistle, Scotch	*Onopordum acanthium*
Toadflax, Dalmation	*Linaria dalmatica*
Toadflax, yellow	*Linaria vulgaris*
Tobacco	*Nicotiana* spp.
Trefoil, bird’s-foot	*Lotus corniculatus*
Vetch, bird	*Vicia cracca*
Water-thyme	*Hydrilla verticillata*
Waterlily	*Nymphaea* spp.
Watermilfoil, Eurasian	*Myriophyllum spicatum*
Woad, Dyer’s	*Isatis tinctoria*
Shrubs and Trees	
Cholla, tree	*Opuntia imbricata*
Creosote bush	*Larrea tridentata*
Douglas-fir	*Pseudotsuga menziesii*
Fir, balsam	*Abies balsamea*
Juniper	*Juniperus* spp.
Juniper, oneseed	*Juniperus monosperma*
Juniper, Utah	*Juniperus osteosperma*
Juniper, western	*Juniperus occidentalis*
Mesquite	*Prosopis* spp.

Common Name	Scientific Name
PLANTS (Cont.)	
Mesquite, honey	*Prosopis glandulosa*
Mesquite, velvet	*Prosopis velutina*
Mormon tea	*Ephedra viridis*
Mountain mahogany, alderleaf	*Cercocarpus montanus*
Oak, Gambel	*Quercus gambelii*
Oak, scrub	*Quercus dumosa*
Olive, Russian	*Elaeagnus angustifolia*
Paloverde	*Parkinsonia* spp.
Pine, Jeffrey	*Pinus jeffreyi*
Pine, ponderosa	*Pinus ponderosa*
Pinyon	*Pinus edulis*
Pinyon, Singleleaf	*Pinus monophylla*
Pinyon, twoneedle	*Pinus edulis*
Pricklypear	*Opuntia* spp.
Rabbitbrush	*Chrysothamnus* spp. and *Ericameria* spp.
Sagebrush	*Artemisia* spp.
Sagebrush, basin big	*Artemisia tridentata* ssp. *tridentata*
Sagebrush, Wyoming big	*Artemisia tridentata* ssp. *wyomingensis*
Salal	*Gaultheria shallon*
Saltcedar (tamarisk)	*Tamarix ramosissima*
Sassafras	*Sassafras albidum*
Serviceberry, Utah	*Amelanchier utahensis*
Tamarisk	*Tamarix* spp.
Yew	*Taxus* spp.
Yucca	*Yucca* spp.
INVERTEBRATES	
Earthworm	*Oligochaeta* spp.
FISH	
Salmon	*Oncorhynchus* spp.
BIRDS	
Bobwhite, northern	*Colinus virginianus*
Dove	Various species
Plover, mountain	*Charadius montanus*
Prairie-chicken, lesser	*Tympanuchus pallidicinctus*
Quail, mountain	*Oreortyx pictus*
Robin, American	*Turdus americanus*
Sage-grouse	*Centrocercus* spp.
MAMMALS	
Burro	*Equus asinus*
Cottontail	*Sylvilagus* spp.
Coyote	*Canis latrans*
Deer	*Odocoileus* spp.
Deer, mule	*Odocoileus hemionus*
Deer, white-tailed	*Odocoileus virginianus*
Elk	*Cervus elaphus*
Goat (domestic)	*Capra hircus*
Horse	*Equus caballus*
Jackrabbit	*Lepus* spp.
Peccary, collared	*Tayassu tajacu*
Prairie dog	*Cynomys* spp.

Common Name	Scientific Name
MAMMALS (Cont.)	
Pronghorn	*Antilocapra americana*
Sheep (domestic)	*Ovis aries*

APPENDIX B

TRIBAL AND AGENCY CONSULTATION

TRIBAL CONSULTATION

United States Department of the Interior
BUREAU OF LAND MANAGEMENT
Washington, D.C. 20240
http://www.blm.gov

APR 18 2013

In Reply Refer To:
1793 (220)

Dear Tribal Leader:

The Bureau of Land Management (BLM) would like to extend an invitation to you for Government-to-Government consultation to exchange information on the proposed use of three new herbicides to treat vegetation on BLM-administered lands. We are currently preparing a Programmatic Environmental Impact Statement (PEIS) on this proposed action.

This letter includes information about the three new herbicides and how they would be used, if approved. It also briefly discusses the risks and possible impacts associated with using them. A "Frequently Asked Questions" sheet and a map of the potentially affected areas are attached to this letter to provide further information about the project.

Herbicides are one part of a larger vegetation treatment program that has a goal of conserving and restoring native vegetation, watersheds, and fish and wildlife habitat. As you may know, in 2007 the BLM completed a PEIS that discussed possible impacts to plants, fish, wildlife, and other resources from the use of 18 different herbicides to control unwanted vegetation. The document considered paleontological resources, cultural resources, subsistence resources, and the health of Native Americans that may be exposed to these herbicides.
http://www.blm.gov/wo/st/en/prog/more/veg_eis.html

The BLM has recently decided that it would like to use three additional herbicides to treat vegetation. These chemicals are aminopyralid, fluroxypyr, and rimsulfuron. A new PEIS is being prepared to discuss the possible impacts of using these three to treat vegetation.

Aminopyralid is a reduced-risk herbicide that controls numerous weed species, including mustard species, knapweeds, starthistles, and thistles. It also can help control cheatgrass, also known as downy brome. Aminopyralid is registered under the U.S. Environmental Protection Agency's reduced risk initiative, indicating that it poses less risk to human health and the environment than other herbicides. Aminopyralid may be used instead of picloram in certain BLM treatment projects.

Fluroxypyr is used to control annual and perennial broad-leaved weeds (such as marestail and cocklebur), and can be used to control weeds while maintaining grass forage species. The BLM has indicated that this herbicide can help reduce the amount of other herbicide products used in treatments. It can also be tank-mixed with other herbicides to improve their effectiveness.

Rimsulfuron is used to control winter annual grasses. The BLM has identified rimsulfuron as a useful addition to its list of herbicides because of its effectiveness against cheatgrass and medusahead rye, if the treated site is rested from livestock grazing for a year to allow desirable species to become established. Rimsulfuron has been observed to be more effective than imazapic in certain areas.

An assessment of the risks to humans, terrestrial wildlife, aquatic species, and non-target plants from using these chemicals has been completed. Based on the results of these assessments, aminopyralid, fluroxypyr, and rimsulfuron are relatively low risk chemicals. They do not pose unacceptable health risks to humans under exposure scenarios involving contact with treated plant materials or water, or ingestion of treated water, berries, or fish. The herbicides pose low risks to terrestrial wildlife and aquatic species, but can impact non-target plants under various scenarios.

Vegetation treatments with the three new herbicides could occur anywhere on BLM-administered lands in Alaska, Arizona, California, Colorado, Idaho, Kansas, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, Oregon, South Dakota, Utah, Washington, and Wyoming (see attached map). This is approximately the same area that was considered in the 2007 PEIS.

The BLM recently completed public scoping and is in the process of reviewing the comments that were received and identifying alternatives to the proposed action. It is anticipated that a Draft PEIS will be completed this summer.

The BLM appreciates our relationship and will continue to consult with you throughout the PEIS process, and as more specific treatment projects in your geographic area are developed and implemented. We will continue to keep you informed, and are always open to any feedback you may have. In the meantime, we hope to hear from you during the PEIS process through one of the many avenues available for communication with us, including a written or telephone response to this letter, or through contact with the local BLM field or state office. We are particularly interested in three issues: 1) specific concerns that you have about the use of aminopyralid, fluroxypyr, and rimsulfuron on public lands; 2) potential impacts on subsistence plants and animals, and on traditional cultural properties; and 3) potential impacts on resources associated with reserved rights under treaty, where they exist. Please let us know whether you would like to provide information and if you would like to receive review copies of the documents that we produce.

Thank you for your participation in the PEIS process. We look forward to exchanging information with you about the proposed project. If submitting written comments, please send your comments to Stuart Paulus, AECOM Project Manager, 710 Second Avenue, Suite 1000, Seattle, WA 98104. If you have any questions or concerns, or would like additional information, please feel free to call the PEIS Team Leader, Gina Ramos, at (202) 912-7226

Sincerely,

Edwin L. Roberson
Assistant Director
Renewable Resources and Planning

Enclosures

BUREAU OF LAND MANAGEMENT

VEGETATION TREATMENTS PROGRAMMATIC EIS FOR USE OF THREE NEW HERBICIDES ON PUBLIC LANDS IN THE WESTERN U.S., INCLUDING ALASKA

FREQUENTLY ASKED QUESTIONS

Q. What is the Bureau of Land Management (BLM) proposing to do?

A. The BLM is proposing to prepare a programmatic Environmental Impact Statement (PEIS) to evaluate the viability of using aminopyralid, fluroxypyr, and rimsulfuron herbicides as part of BLM vegetation treatment programs. The new EIS will comply with National Environmental Policy Act (NEPA) regulations. In 2007, the BLM prepared the *Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in 17 Western States Programmatic Environmental Impact Statement* (17-States PEIS). Under the Record of Decision for the 17-States PEIS, the BLM is allowed to use 18 herbicides. If approved for use, up to three new herbicides will join the list of EIS-approved herbicides currently in use on BLM lands. The purpose of vegetation treatment programs includes the conservation and restoration of vegetation, fish, and wildlife habitat; improvement of watershed functions; fuels and fire management; invasive and noxious weeds management; and soil stabilization.

Q. Where would the proposed actions occur?

A. If approved, the new herbicides could be utilized on public lands administered by the BLM in the western U.S. and Alaska. The majority of these lands are in Alaska, Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming. Field offices and personnel would not be required to use the three herbicides unless they deem it appropriate.

Q. Will the EIS include National Monuments and National Conservation Areas?

A. Yes, since the 2007 17-States PEIS included these lands in its analysis. These units are already included as part of the broad programmatic treatment area to the extent that conservation and restoration project work, including invasive and noxious weed treatments, are allowed by the individual National Landscape Conservation System proclamations.

EIS Development Process

Q. Why is the BLM developing this programmatic EIS?

A. The BLM is preparing a programmatic EIS to evaluate the potential for use of three new herbicides for the conservation and restoration of vegetation, watershed functions, and fish and wildlife habitat on surface lands administered by the BLM in the western U.S., including Alaska.

Q. Is this EIS a land-use plan?

A. No, this EIS is not a land-use plan. The scope of this EIS is restricted to assessing the viability of incorporating treatments with the three new herbicides into existing vegetation treatment strategies.

Q. What is the difference between a programmatic EIS and project-specific EIS?

A. A programmatic EIS is designed to look at the broad, general impacts associated with a decision to fully implement a program or additional treatment. A programmatic EIS also allows for the tiering of more site-specific NEPA documents, such as land-use plans, eliminating the need for repetitive discussions of the same issues. A project-specific EIS looks at impacts associated with a site-specific project, such as vegetation treatment activities on 1,000 acres of BLM-administered lands.

Q. Who is developing the EIS?

A. The BLM Office of Forest, Range, Riparian and Plant Conservation in Washington, D.C., is leading the project, supported by BLM technical resource specialists in BLM offices throughout the western U.S. and Alaska.

Q. How much has been done so far, and what is the next step?

A. The Notice of Intent to develop the EIS was published in the Federal Register on Friday, December 21, 2012, and a news release was distributed to the media, interested groups, and state agencies by the BLM at the same time. The schedule for scoping meetings was also published in the Federal Register, and this "Questions and Answers" information sheet was made available through the BLM website at www.blm.gov/3kvd. Three public scoping meetings will be held throughout the western U.S. in January 2013 during the 60 day public scoping process.

Potential Issues to Be Examined in the EIS

Q. Does this EIS involve controversial issues?

A. It is anticipated that most public scrutiny will focus on issues associated with the use of new herbicides to control noxious weeds and other vegetation. Specific issues to be addressed in the EIS include the effects of the three new herbicides on human and environmental health, on threatened and endangered species, and on resources used by Native Americans and Alaska Native groups.

Q. Will there be an assessment of risks to the public and the environment from the use of herbicides?

A. Ecological and human health risk assessments were done to determine the likely risks to humans, plants, and fish and wildlife from the treatments involving the three new herbicides proposed for use by the BLM. The EIS will not evaluate the risks from herbicides presently being used by the BLM, which have already been evaluated in the earlier EISs, unless new information has become available to suggest that these herbicides require further evaluation.

Q. Will there be a process developed to determine which new chemicals the BLM can use to control vegetation?

A. The 2007 17-States PEIS already includes protocols that the BLM follows to evaluate new chemicals that may be developed in the future, prior to their use by the agency. New herbicides could only be used if they are: (1) registered for use by the EPA; (2) used for treatment of appropriate vegetation types and at application rates specified on the label directions; and (3) determined by the BLM to be safe to humans and the environment, based on an analysis of their potential toxicological and environmental impacts.

Public Involvement

Q. When will the public be able to make comments on the project?

A. NEPA regulations require federal agencies to seek public input during development of the EIS. The public will have several opportunities to discuss this project with the BLM and to make comments by:

1. Attending any of the scoping meetings listed in the table below:

Location	Date	Meeting Time
Worland Field Office, 101 South 23rd, Worland, WY (307) 347-5100	January 7, 2013	7 pm local
Hyatt Place Reno Airport, 1790 East Plumb Lane, Reno, NV (775) 826-2500	January 9, 2013	7 pm local
Albuquerque District Office, 435 Montano Road NE, Albuquerque, NM (505) 761-8700	January 10, 2013	7 pm local

2. Submitting comments on issues identified in the scoping process within 60 days of the Federal Register's Notice of Intent published on December 21, 2012. The closing date for submission of comments is February 19, 2013.

3. Submitting comments during additional public comment periods associated with the Draft EIS and Final EIS.

Q. How can the public comment on the program?

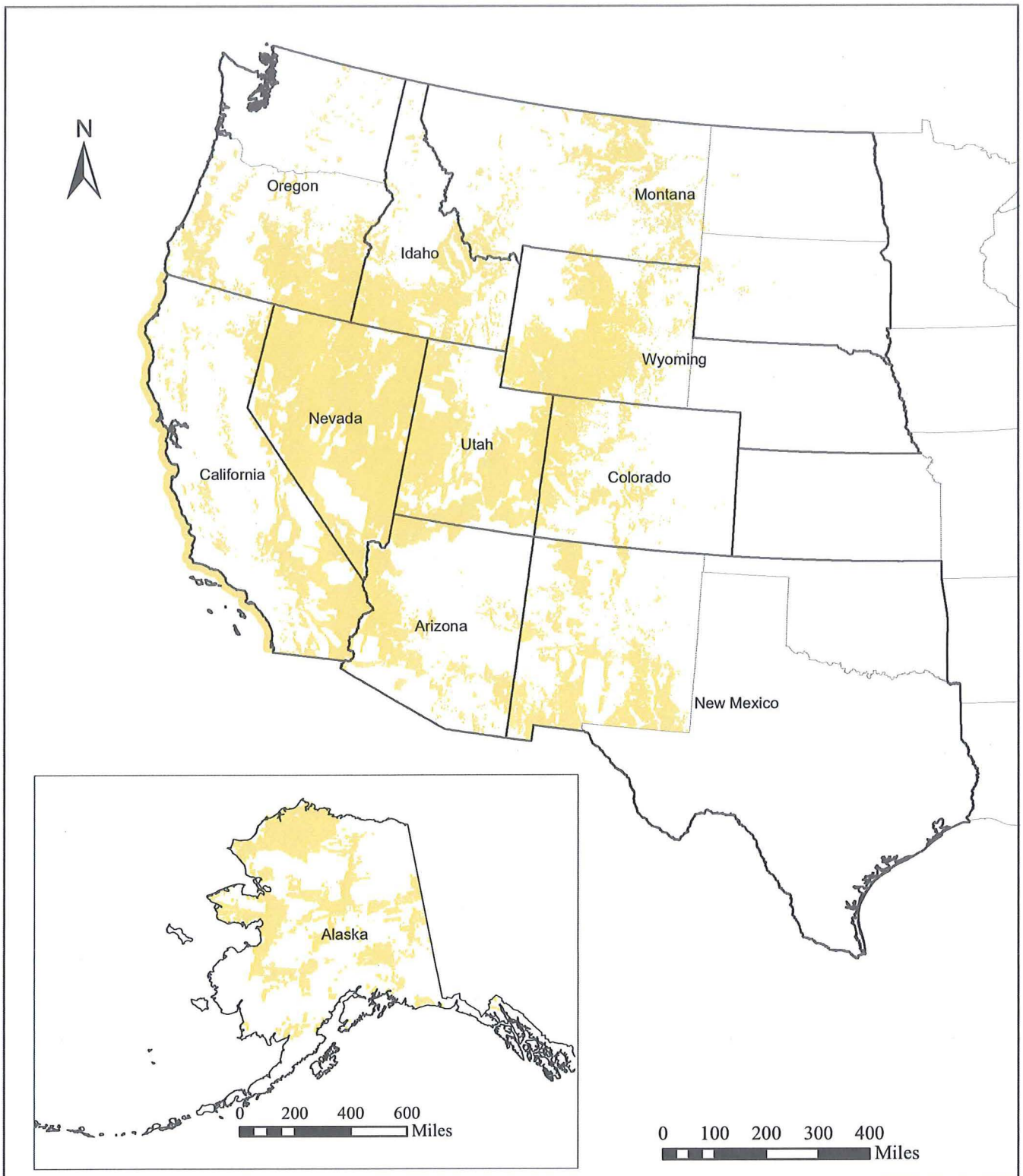
A. The public can provide formal comments to the court reporter who will be available during each scoping meeting. Forms to submit written comments will also be available during scoping meetings, and at local BLM offices, and may be turned in to the BLM at the scoping meeting or local office. These forms can also be emailed to VegEIS@blm.gov.

Q. What will be done with these comments?

A. The comments will be compiled and summarized by major resource areas and issues in a scoping summary report. Public comments and the scoping summary report will be used to evaluate issues and concerns associated with the proposed program, and to develop alternative programs to treat vegetation using the new herbicides on BLM-administered lands. The scoping summary report will be made available to the public in late spring.

Q. How can I find out more information and follow the progress of the new EIS?

A. Interested individuals can visit http://www.blm.gov/wo/st/en/prog/more/vegeis.html for regular updates on the EIS process. The website will be available throughout the public scoping process.



BLM-Administered Lands

Administrative Boundaries

Note: Coverage for BLM-administered lands is not available for Texas, Nebraska, or Oklahoma.

Source: National Atlas Federal Lands GIS Data

Vegetation Treatments Using Aminopyralid, Fluroxypyr, and Rimsulfuron on BLM Lands in 17 Western States PEIS

Map 1
PEIS Study Area

Chickaloon Village Traditional Council
(Nay'dini'aa Na')

Chief Gary Harrison, *Chairman*
Rick Harrison, *Vice-Chairman*
Penny Westing, *Secretary/Elder*
Albert Harrison, *Treasurer/Elder*
Burt Shaginoff, *Elder Member*
Doug Wade, *Elder Member*
Larry Wade, *Elder Member*
Shawna Larson, *Member*
Lisa Wade, *Member*
Jennifer Harrison, *Executive Director*

October 30, 2013

Edwin L. Roberson
Assistant Director
Renewable Resources and Planning
U.S. Department of the Interior
Bureau of Land Management

Dear Mr. Roberson,

Thank you for the invitation to initiate government-to-government consultation concerning the proposed use of three new herbicides to treat vegetation on BLM-administered lands. Although this letter serves as a beginning to a government-to-government consultation, we must emphasize that this correspondence does not fulfill your obligation to consult and engage fully and in person with the Chickaloon Village Traditional Council prior to and regarding any decisions about the use of herbicides on BLM-administered lands, lands traditionally used by our Tribal Citizens.

Background and Short History

Chickaloon Native Village is a vibrant, innovative, and culturally rich Ahtna Athabascan Tribe based in Sutton in south-central Alaska. As a response to the environmental and social injustice suffered by Chickaloon Village Tribal Citizens, coupled with the passing of the Alaska Native Claims and Settlement Act (ANCSA) of 1971, our Elders re-established the Chickaloon Village Traditional Council (CVTC) in 1973, to reassert the Tribe's identity, cultural traditions, economic self-sufficiency and to reunify our citizens. The mandate for the Council was: *To restore our traditional worldview by rejuvenating our traditional Athabascan culture, values, oral traditions, spirituality, language, songs, and dance.* Chickaloon Native Village gained federal recognition in 1973 and on November 24, 1982, according to Federal Register Vol. 58, No. 202. We are governed by a nine-member Traditional Council (CVTC), tasked to reassert the Tribes identity and cultural traditions, and create economic self-sufficiency for the Tribe. It is the vision of our Tribe's Land Use Committee to have land, water and air that is cleaner and healthier than it is today, to sustain our community's life needs, balancing stewardship of the natural world and economic development for our current and future generations. It is our mission to educate, guide, advocate for and develop policy that protects the integrity of natural habitats while supporting development that respects ecological limits.

Findings Concerning the Proposed Use of New Herbicides

Chickaloon Village Traditional Council exercises powers of self-government by reason of its original tribal sovereignty as passed down from our ancestors since time immemorial with a responsibility to protect the health and well-being of our Tribal Citizens. The Council has responsibility to prevent contamination that may harm present or future

RECEIVED
NOV 15 2013
BLM-R&P-W0200

P. O. BOX 1105 Chickaloon, Alaska 99674 Phone (907) 745-0707 Fax (907) 745-0709
e-mail: cvadmin@chickaloon.org *Home Page: http://www.chickaloon.org*

generations and to ensure that we pass on a world with water that is pure to drink, as well as lands and waters that support our customary and traditional way of life. Our Chickaloon Tribal Citizens depend on the harvest of berries, medicinal plants, fish and wildlife for our spiritual, cultural and physical sustenance. We depend on the lands and waters of the watersheds in our region for the safe harvest of our traditional subsistence foods. The people of the Native Village of Chickaloon are concerned about the proposed use of any herbicides, including the proposed new herbicides by the BLM and potential harm to our health. Herbicide applications are designed to destroy the growth of plant life and are toxic to the environment because they adversely affect non-target plants, animals, and people. The use of herbicides, including aminopyralid, fluroxypyr, and rimsulfuron, will have detrimental effects to non-target plants, wildlife and people. Herbicide chemical treatments will have a detrimental effect on the lands, waters, and air as well as fish and wildlife resources that Native people rely on for hunting, fishing, and gathering for their daily food. These herbicides may harm the health of the Native people who use our traditional lands and waters. The use of herbicides violates Article 29 of the United Nations Declaration on the Rights of Indigenous Peoples to ensure that disposal of hazardous materials shall not take place in the lands and territories of our Indigenous peoples without their free, prior and informed consent. We believe that there are effective and viable alternatives to the use of herbicides for vegetation management. The Chickaloon Village Traditional Council finds as a matter of tribal policy that the use of herbicides is detrimental to land, waters, and air resources as well as fish and wildlife that Alaska Native people use in our daily lives and that the use of herbicides will have a detrimental effects on the health of our people. Therefore, our Council opposes the use of herbicides for vegetation management and calls upon BLM to adopt a policy of prohibiting the use of herbicides. We find that BLM does not provide justification for the use of the proposed new herbicides nor does the agency discuss non-chemical vegetation management options.

There is very little information or studies available in the open scientific and peer-reviewed literature on the ecological and human health consequences of the use of aminopyralid because it is a relatively new pesticide. What little information exists is based almost exclusively on studies submitted to the U.S. EPA by the chemical corporation Dow AgroSciences in support of the registration of aminopyralid. Non-target plants, particularly dicots (broadleaf plants) are sensitive to the herbicide and will be adversely affected by applications of aminopyralid[1]. Studies have shown that exposure of non-target plants to aminopyralid causes damage including deformed leaves and stems, as well as reduced fruit production at low concentrations[2]. It is quite persistent in soils, with demonstrated half-lives of 32-533 days. Compost and manure contaminated with residues of aminopyralid causes damage to and economic losses of crops on which the compost or manure have been applied. Research also show that aminopyralid altered native plant communities[3]. In a study of the effects of aminopyralid, crops were injured by the herbicide at soil concentrations less than the limit of quantitation (0.2 µg kg (-1)[4]. Developmental studies involving gavage administration in adult female rabbits documented signs of incoordination upon exposure. In the rabbit study, developmental toxicity was shown by a decrease in fetal body weights. Effects on the nervous system are not well documented. "It seems reasonable to assume the most sensitive effects in wildlife mammalian species will be the same as those in experimental mammals (e.g., changes in the gastrointestinal tract, weight loss, and incoordination)."[5] EPA issued a

P. O. BOX 1105 Chickaloon, Alaska 99674 **Phone (907) 745-0707 Fax (907) 745-0709**
e-mail: cvadmin@chickaloon.org ***Home Page: http://www.chickaloon.org***

conditional registration for aminopyralid in 2005 and it is not scheduled for review until 2020. It should not be categorized by BLM as a "reduced risk" herbicide because its evaluation is incomplete. To our knowledge, there have not been studies of this herbicide on subsistence resources, including medicinal plants, herbs, berry plants, fish or wildlife, particularly in our traditional use areas. It is likely that aminopyralid is more persistent in our colder environment and may cause more damage to northern species and ecosystems. For the other two herbicides, fluroxypyr and rimsulferon, we find that there is also insufficient information in the peer-reviewed literature with which to make reasoned assessments concerning the ecological and human health implications of their use. Therefore, we are opposed to their use as a precautionary measure.

Non-chemical methods exist that are effective and economical. New technologies and products have been developed that provide safe, economical alternatives to the use of herbicides. For example, the provincial government of British Columbia recommends the use of ecological vegetation management rather than the use of herbicides. The government's Integrated Pest Management Program notes that "repeated herbicide applications to keep sites bare, such as around electrical substations, along a fence lines or railroad tracks, will encourage the growth of weeds. The herbicides create a disturbance, both in the vegetation, and, depending on the herbicide, in the soil--which then encourages weed invasion. This disturbance is not limited to the area of application, but may be felt in the vegetation for some distance away...Minimizing herbicide use can reduce weed growth and result in cost effective vegetation management systems."[6] Integrated pest management includes cultural methods, mechanical removal, cultivation, mulching, flaming, hot water, controlled burning, or a variety of non toxic herbicides based on corn meal gluten, vinegar, or microbial agents.

Several forms of alternative herbicides have recently come on the market and are currently a very active research subject in Canada. Corn meal gluten applied to mature grass over multiple seasons acts as a pre-emergent herbicide to suppress clover, dandelion and other weed growth by up to 90%. Vinegar (acetic acid) effectively kills many weeds when applied directly to the shoots, and *Cirsium arvense*, the invasive thistle targeted by this permit application, is particularly susceptible according to USDA tests. The Environmental Protection Agency recently approved at least one commercial vinegar-based mixture; a vinegar-based product would be an excellent choice for weed control as vinegar degrades quickly into nontoxic components.[7]

Herbicide applications are likely to result in higher economic and ecological costs over the long term, as plants develop resistance to herbicide applications. Despite earlier claims that glyphosate resistance was unlikely, at least 19 weed species have developed glyphosate-resistant strains in agricultural areas worldwide[8]. Field studies in Washington state showed that star thistle repeatedly treated with picloram developed resistance to not only the herbicide actually uses, picloram, but to other herbicides (including chlorpyralid) with the same mode of action.[9] The use of herbicides will perpetuate resistance of the vegetation to treatment and will not be effective in vegetation management in the future. Herbicide-resistant weeds may also spread into areas beyond the application sites, thereby increasing the problem and cost of weed control. We assert that there are new and proven methods and technologies that preclude the need for synthetic herbicides, including new acetic acid-based products, improved infrared steam

P. O. BOX 1105 Chickaloon, Alaska 99674 **Phone (907) 745-0707 Fax (907) 745-0709**
e-mail: cvadmin@chickaloon.org ***Home Page: http://www.chickaloon.org***

technology, cultural and biological control methods. We maintain that an integrated non-chemical approach would be highly effective and preferable to threatening environmental and community health.

On August 1, 2006 the Attorney General of Alaska announced that Alaska "joined with 13 other states and the U.S. Virgin Islands to petition the Environmental Protection Agency (EPA) to require pesticide manufacturers to disclose on the label of their product all hazardous ingredients...The EPA currently requires that pesticide labels disclose only the product's "active" ingredients that contain toxic materials intended to kill insects, weeds, or other target organisms. Pesticide products also contain many other "inert" ingredients, which are intended to preserve or improve the effectiveness of the pesticides' active ingredients. These "inert" ingredients may be toxic themselves..." The news release further states that "people who use or who are impacted by the use of a pesticide should have notice of all that product's potential health risks." Thus, it would be wrong for BLM to apply herbicides for which the manufacturers do not disclose ingredients that may harm human health.

Dr. Warren Porter, Professor of Environmental Toxicology at the University of Wisconsin, Madison, completed a review of the literature concerning the environmental health effects of low-dose chemical mixtures of pesticides.[10] He concluded:

- Pesticides have interactive effects and ultra low-level effects that are below EPA allowable levels. These effects include adverse neurological, endocrine, immune, reproductive and developmental health outcomes.

- EPA assessments of biological risk can be off by a factor of 10,000 at ultra low doses. Scientists call for a new type of risk assessment in the open literature because of the inadequacies of the current EPA pesticide registration system.

- Pesticides have broad biological effects that are unintended and often unpredictable because of physicochemical properties engineered into their molecules.

- Pesticides of different classes can have similar impacts on endocrine disruption and sexual development. Chemicals affect development at levels in the tenths of a part per billion range.

In the preeminent peer-reviewed environmental health journal published by the National Institute for Environmental Health Sciences, *Environmental Health Perspectives*,[11] the authors warn: "Inert ingredients may be biologically or chemically active and are labeled inert only because of their function in the formulated product...Inert ingredients can increase the ability of pesticide formulations to affect significant toxicological endpoints, including developmental neurotoxicity, genotoxicity, and disruption of hormone function. They can also increase exposure by increasing dermal absorption, decreasing the efficacy of protective clothing, and increasing environmental mobility and persistence. Inert ingredients can increase the phytotoxicity of pesticide formulations, as well as toxicity to fish, amphibians, and microorganisms." In the case of this permit application, the active ingredients cannot be used without an adjuvant and/or surfactant. The scientific literature supports the fact that the use of surfactants/adjuvants increases the

P. O. BOX 1105 Chickaloon, Alaska 99674 **Phone (907) 745-0707 Fax (907) 745-0709**
e-mail: cvadmin@chickaloon.org ***Home Page: http://www.chickaloon.org***

bioavailability, toxicity, persistence, and bioaccumulation of the active ingredient.

For the reasons stated above, Chickaloon Village Traditional Council firmly opposes the use of these and other herbicides because of the hazards posed to ecological and human health. We are particularly vulnerable to the effects of these chemicals due our reliance on medicinal plants and traditional foods. We anticipate that BLM will initiate formal government-to-government consultation with our Tribe as mandated.

May Creator Guide Our Footsteps,

Chief Gary Harrison

Chief Gary Harrison,
Chairman

1

] Human Health and Ecological Risk Assessment Final Report for Aminopyralid. 2007. Prepared for the USDA/Forest Service and National Park Service. SERA TR-052-04-04a.

2

] Aminopyralid, Chemical Watch Fact Sheet. Beyond Pesticides, 2011.

3

] Almquist TL and RG Lym. 2010. Effect of aminopyralid on Canada thistle and the native plant community in a restored tallgrass prairie. Invasive Plant Science and Management 3(2):155-168.

4

] Fast BJ et al. 2011. Aminopyralid soil residues affect rotational vegetable crops in Florida. Pest Management Science 67(7):825-830.

5

] Human Health and Ecological Risk Assessment Final Report for Aminopyralid. 2007. Prepared for the USDA/Forest Service and National Park Service. SERA TR-052-04-04a.

6

] Provincial Government of British Columbia Integrated Pest Management Programme—B.C. Pest Monitor Newsletter: http://www.env.gov.bc.ca/epd/ipmp/publications/pest_monitor/vol5_1.htm. Accessed September 14, 2009.

7

] Quarles, W. 2010. Alternative herbicides in turfgrass and organic agriculture. *The IPM Practitioner: Monitoring the Field of Pest Management.* 22(5/6) May/June 2010.

8

P. O. BOX 1105 Chickaloon, Alaska 99674 **Phone (907) 745-0707 Fax (907) 745-0709**
e-mail: cvadmin@chickaloon.org ***Home Page: http://www.chickaloon.org***

┐ A. J. Price, K. S. (2011). Glyphosate-resistant Palmer amaranth: A threat to conservation tillage. *Journal of Soil and Water Conservation* , *66* (4), 265-275.

x Provincial Government of British Columbia Integrated Pest Management Programme—B.C. Pest Monitor Newsletter: http://www.env.gov.bc.ca/epd/ipmp/publications/pest_monitor/vol5_1.htm. Accessed September 14, 2009.

9

┐ Sabba, R.P. et al. 2003. Inheritance of Resistance to Clopyralid and Picloram in Yellow Starthistle (Centaurea solstitialis L.) Is Controlled by a Single Nuclear Recessive Gene. *Journal of Heredity.* 94(6):523–527

10

┐ Porter, W. 2005. Report as an expert witness.

11

┐ Cox, C. and M. Surgan. 2006. Unidentified inert ingredients in pesticides: implications for human and environmental health. Environmental Health Perspectives www.ehponline.org/docs/2006/9374/abstract.pdf

P. O. BOX 1105 Chickaloon, Alaska 99674 **Phone (907) 745-0707 Fax (907) 745-0709**
e-mail: cvadmin@chickaloon.org ***Home Page: http://www.chickaloon.org***

Kashia Band of Pomo Indians
of the Stewarts Point Rancheria

May 3, 2013

Please note that there have been changes to our Tribal Council and Administration.

Emilio Valencia, Tribal Chairman
Sandy Pinola, Tribal Vice-Chairman
Violet Wilder, Tribal Secretary
Glenda Jacob-McGill, Tribal Treasurer
Elayne May-Muro., Member-At-Large
Angelique Lane, Member-At-Large
Dino Franklin, Member–At-Large
Teresa Romero, Tribal Administrator
Jerry Rice, Fiscal Officer
Otis Parrish, THPO
Jan Guthrie, Housing Director
Nina Hapner, Environmental Director

Please note that we have moved and our new address is: **1420 Guerneville Road, Suitet 1, Santa Rosa, CA 95403.** Please address further correspondence to the current Chairperson above.

If you have any questions, please contact our office at (707) 591-0580.

Sincerely,

Lenora Vigil-Moya

Lenora Vigil-Moya
Front Office Receptionist

cc: file

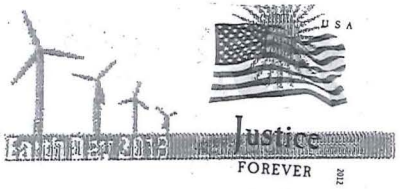
1420 Guerneville Road, Suite 1 • Santa Rosa, CA 95403
(707) 591-0580 • (707) 591-0583 Fax • email: tribalofc@stewartspoint.org

AECOM

AECOM
710 Second Avenue
Suite 1000
Seattle, WA 98104

SEATTLE WA 980

29 APR 2013 PM 1 L



Emilio Valencia

Ralph Sepulveda , Chairman
Kashia Band of Pomo Indians of the
Stewarts Point Rancheria
3535 Industrial Drive, Suite B-2
Santa Rosa. CA 95403

980 N7F 1 6127 00 04/29/13
NOTIFY SENDER OF NEW ADDRESS
KASHIA BAND OF POMO INDIANS OF THE S
1420 GUERNEVILLE RD STE 1
SANTA ROSA CA 95403-4124

BC: 95403412401 *3026-21775-29-39

95403@4124

KOI NATION OF NORTHERN CALIFORNIA

Koi Nation Information Update

This is the current information for the Koi Nation of Northern California (formerly Lower Lake Rancheria Koi Nation)

Chairman: Darin F. Beltran

Office Phone #: (707)575-5586

Office Fax #: (707)575-5506

Address: P.O. Box 3162

Santa Rosa, CA 95402

Email Address: kn@koination.com

Website: koination.com

Please update your contact information.

Thank you very much,

Tribal Council of the Koi Nation of Northern California

NAKNEK NATIVE VILLAGE

P.O. BOX 210 • Naknek, Alaska 99633
Phone: 907.246.4210 • Fax: 907.246.3563

Naknek Native Village Council
PO Box 210
Naknek, AK, 99633
Phone: 1-907-246-4210
Fax: 1-907-246-3563
nnvcpresident@gmail.com

AECOM
710 Second Avenue, Suite 100
Seattle, WA 98104

To Whom It May Concern:

The Naknek Native Village Council is writing to inform AECOM that Leon Kiana is no longer the Naknek Native Village Council Administrator. Please direct all mail, questions/concerns and correspondence to Mr. Patrick Patterson Jr., Naknek Village Council President until further notice.
The Naknek Native Village Council would like to also request an update in address and contact information. Our current contact information is as listed on the top of this letter.

Sincerely,

Patrick Patterson Jr.
Naknek Village Council President

Native Village of Unalakleet
PO Box 270
Unalakleet, AK 99684
(907) 624-3622

June 14, 2013

Stuart Paulus, AECOM Project Manager
710 Second Avenue, Suite 1000
Seattle, WA 98104

RE: Proposed Use of three new herbicides to treat vegetation on BLM-administered lands

Dear Mr. Stuart Paulus:

The Native Village of Unalakleet (NVU) received an invitation for a government-to-government consultation to exchange information on the proposed use of three new herbicides to treat vegetation on BLM-administered lands. The NVU Tribal Council respectfully requests that BLM not spray these herbicides on the Unalakleet River. The Tribal Membership of Unalakleet harvests berries, greens, fish and game from the Unalakleet River and everywhere in its vicinity.

Please forward any pertinent information about immediate or perceived threats to the natural flora and fauna caused by invasive plant species that you would like to target. The Native Village of Unalakleet Tribal Council will meet again on June 20, 2013 and can notify you of future dates if need be.

Please do not hesitate to call us if you have questions or need more information.

Sincerely:

Kermit Ivanoff Sr, President

CC: file
NVU Tribal Council

PALA TRIBAL HISTORIC PRESERVATION OFFICE

PMB 50, 35008 Pala Temecula Road
Pala, CA 92059
760-891-3510 Office | 760-742-3189 Fax

PALA THPO

May 7, 2013

Stuart Paulus, Project Manager
AECOM
710 Second Avenue, Suite 1000
Seattle, WA 98104

Re: Government-to-Government Consultation on the Proposed Use of Three New Herbicides to Treat Vegetation on BLM-Administered Lands

Dear Mr. Paulus,

We are in receipt of a letter from Edwin L. Roberson, Assistant Director, Renewable Resources and Planning of the Bureau of Land Management regarding a proposal to approve three new herbicides for use on BLM-administered public lands. This letter constitutes our response on behalf of Robert Smith, Chairman of the Pala Band of Mission Indians.

At this time, we do not request formal government-to-government consultation on the proposed action. Further, we do not have any specific concerns about the proposed herbicides, nor do we have any reserved rights under treaty. However, we would like to comment that consultation on the use of new herbicides should be specific to the Indian nations that may be impacted by their use. That is, as herbicide applications are scheduled for specific areas, the local tribes should be contacted so they are aware that native plant resources might be affected, and they can plan accordingly. They should also be contacted for information regarding TCPs and other significant areas that may be impacted by scheduled applications.

Thank you for the opportunity to comment.

Sincerely,

Shasta C. Gaughen, PhD
Tribal Historic Preservation Officer
Pala Band of Mission Indians

STATE HISTORIC PRESERVATION OFFICE CONSULTATION

KSR&C No. 13-05-019

6425 SW 6th Avenue
Topeka, KS 66615

Kansas

phone: 785-272-8681
fax: 785-272-8682
cultural_resources@kshs.org

Kansas Historical Society

Sam Brownback, Governor
Jennie Chinn, Executive Director

May 1, 2013

Stuart Paulus
AECOM Project Manager
710 Second Avenue, Suite 1000
Seattle WA 98104

RE: Herbicide Treatments
1793(220)
Statewide

Dear Mr. Paulus,

Our staff has reviewed the materials received April 26, 2013, regarding the above referenced project in accordance with 36 CFR 800. The SHPO has determined the proposed project will not adversely affect any property listed or eligible for listing in the National Register of Historic Places. Please refer to the Kansas State Review & Compliance number (KSR&C#) listed above on any future correspondence.

If you have any questions regarding this review, please contact Kim Gant (785) 272-8681 ext. 225.

Sincerely,
Jennie Chinn
State Historic Preservation Officer

Patrick Zollner

Patrick Zollner
Director, Cultural Resources Division
Deputy State Historic Preservation Officer

Big Sky. Big Land. Big History.
Montana
Historical Society

Historic Preservation
Museum
Outreach & Interpretation
Publications
Research Center

STUART PAULUS
AECOM MANAGER
710 SECOND AVE
SUITE 1000
SEATTLE WA 98104

RE: PEIS for Aminopyralid, Fluroxypyr and Rimsulfuron Herbicides

Mr. Paulus:

We know of no direct or indirect effect potential to Historic Properties as a result of application of these herbicides. We recommend eliciting tribal comments or concerns regarding potential impacts resulting from use of culturally important plants which might be treated as either target or non-target plants.

Thank you for providing us an opportunity to comment.

Stan Wilmoth

Stan Wilmoth, Ph.D.
State Archaeologist/deputy, SHPO

225 North Roberts Street
P.O. Box 201201
Helena, MT 59620-1201
(406) 444-2694
(406) 444-2696 FAX
montanahistoricalsociety.org

STATE HISTORICAL SOCIETY OF NORTH DAKOTA

Jack Dalrymple
Governor of North Dakota

North Dakota State Historical Board

Gereld Gerntholz
Valley City - President

Calvin Grinnell
New Town – Vice President

A. Ruric Todd III
Jamestown- Secretary

Albert I. Berger
Grand Forks

Diane K. Larson
Bismarck

Chester E. Nelson, Jr.
Bismarck

Margaret Puetz
Bismarck

Sara Otte Coleman
Director
Tourism Division

Kelly Schmidt
State Treasurer

Alvin A. Jaeger
Secretary of State

Mark Zimmerman
Director
Parks and Recreation Department

Grant Levi
Acting Director
Department of Transportation

Merlan E. Paaverud, Jr.
Director

Accredited by the American Alliance of Museums since 1989

April 30, 2013

Mr. Stuart Paulus
AECOM Project Manager
710 Second Avenue, Suite 1000
Seattle, WA 98104

ND SHPO Ref: 13-0822 BLM 1793 (220) PEIS on adding three herbicides to list of approved active ingredients for use in vegetation treatments on public lands

Dear Mr. Peters,

We reviewed ND SHPO Ref: 13-0822 BLM 1793 (220) PEIS on adding three herbicides to list of approved active ingredients for use in vegetation treatments on public lands and would like to comment that some herbicides can have a negative impact on historic buildings, monuments and cemetery stones if applied too close to or on the structures. This can be due to salt crystallization, discoloration, change in pH, pitting of surfaces, and accelerated deterioration.
Please see:
http://www.scribd.com/doc/37784733/The-Effects-of-Herbicide-on-Stone-and-Masonry

Thank you for the opportunity to review this PEIS document. Please include the ND SHPO Reference number listed above in further correspondence for this specific project. If you have any questions please contact Susan Quinnell, Review and Compliance Coordinator at (701) 328-3576, or squinnell@nd.gov

Sincerely,

Merlan E. Paaverud, Jr.
State Historic Preservation Officer (North Dakota)

North Dakota Heritage Center • 612 East Boulevard Avenue, Bismarck, ND 58505-0830 • Phone: 701-328-2666 • Fax: 701-328-3710
Email: histsoc@nd.gov • Web site: http://history.nd.gov • TTY: 1-800-366-6888

ENVIRONMENTAL PROTECTION AGENCY CONSULTATION

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF
ENFORCEMENT AND
COMPLIANCE ASSURANCE

APR 12 2013

AECOM
Attn. Stuart Paulus
710 Second Avenue, Suite 1000
Seattle, WA 98104

Dear Mr. Paulus:

The Environmental Protection Agency (EPA) has reviewed the Bureau of Land Management's (BLM) Notice of Intent (NOI), dated December 21, 2012, to prepare an Environmental Impact Statement (EIS) to evaluate the use of aminopyralid, fluroxypyr, and rimsulfuron herbicides as part of the its vegetation treatment programs on public lands in 17 Western States.

According to the NOI, BLM will assess environmental impacts associated with use of the proposed herbicides on all surface estate public lands under its administration in 17 Western States. The need for the proposed action is to expand the existing vegetation treatment program and increase flexibility and options when designing herbicide treatments.

We understand that the use of herbicides is a necessary strategy to control noxious weeds in light of the scope and severity of noxious weed invasions. Therefore, we support the overall purpose of the proposed action to treat vegetation on public lands. The NOI identifies a preliminary list of resources and issues to address in the EIS analysis, including, but not limited to, the effects of the herbicides and their inert ingredients on human, vegetation, fish and wildlife, livestock, water quality, tribal resources; and cumulative impacts.

We offer the following comments for your consideration.

Impacts to Water Resources

We recommend that the EIS analyze potential adverse impacts of the proposed action to water quality and aquatic resources. In particular, we are concerned about the unintended consequences that may result from applications of herbicides such as drift, effects on non-target species, persistence in soils that may erode into waterways. If buffers exist around waterways, EPA recommends that the EIS include information explaining the treatment of invasive plants within buffer zones, as well as information about aquatic invasive plant infestations and how they would be treated to prevent deterioration of water quality within waterbodies found on the analysis area.

Section 303(d) of the Clean Water Act (CWA) requires each state to identify waterbodies that are not meeting or not likely to CWA water quality standards and to develop water quality restoration plans or Total Maximum Daily Loads for these waters. We recommend the EIS demonstrate that there would be no net degradation of water quality to Section 303(d) listed waters. Also, please indicate how use of the proposed herbicides would meet anti-degradation provisions of the CWA that prohibit degrading water quality standards within water bodies that are currently meeting water quality standards.

The proposed chemical treatment may also impact waters that serve as sources of drinking water. The 1996 amendments to the Safe Drinking Water Act require federal agencies that manage lands that drain to drinking water sources to protect these source waters. EPA recommends that the analysis of impacts identify all drinking water sources, any potential contamination of these sources that may result from the proposed action, and measures that would be taken to protect these sources.

EPA is aware that aminopyralid has been detected in surface and groundwater in Montana. The contamination in groundwater has been anecdotally linked to impacts on irrigated plants/crops. Thus, we recommend the EIS explicitly address these groundwater concerns in the water resources section.

Chemical Treatments

We recommend the BLM analyze herbicides to determine whether they: 1) are registered for the intended use, 2) will achieve the desired results, and 3) will have minimal adverse effects on the environment.

Providing the best available information on chemicals is essential in evaluating chemical use in invasive plant control and eradication. If other alternatives such as prevention and mechanical control are not feasible, use of herbicides may provide less environmental impact than the establishment of invasive plants. Issues such as sub-lethal effects on wildlife, reduced breeding/survival of sensitive species, secondary cumulative effects, and unintended effects need to be discussed. Liquid and granular herbicides can be applied broadcast, banded, as spots, or directed to specific plants using appropriate application technology such as mechanized ground equipment, or manual applicators such as backpack sprayers or tree injectors. Use of global positioning systems, specialized application equipment and careful attention to weather conditions can enhance application accuracy and minimize off-site chemical movement. Models can also be used to assess the effectiveness of alternative drift control practices and predict the environmental fate of chemicals before their use.

Since chemical treatment is one of several available vegetation management alternatives, we recommend the BLM discuss the screening process used in deciding whether chemical applications are necessary given other weed treatments are already in use on BLM lands. The BLM must ensure that its use of registered pesticides is consistent with all labeling requirements and coordinate with individual state programs to make sure the new herbicides are registered for the intended use in each state.

Landscape Approach and Cumulative Effects

EPA recommends that the EIS assess the effects of the proposed herbicide applications using a landscape approach because BLM administered lands are often intertwined with a mix of other privately, state, and federally owned lands.

Where infestations cross jurisdictional boundaries, a coordinated effort will increase the likelihood of bringing the invasive population to a manageable level. It is recommended that the EIS process use a landscape approach in assessing cumulative effects and identify what assumptions will be used with respect to adjacent non-BLM lands, as well as the mechanisms for cooperating with other landowners to disclose the sum of individual effects of all projects on local environment. We recommend that BLM consider EPA's *Consideration of Cumulative Impacts in EPA Review of NEPA Documents* [1] when preparing this EIS.

Public Participation and Environmental Justice

We recommend that the EIS disclose what efforts were taken to ensure effective public participation. Also, consistent with Executive Order 12898 (*Federal Actions to Address Environmental Justice in Minority and Low-Income Populations)* the EIS should include an environmental justice analysis to identify low-income and minority populations in the project area and disclose what efforts were taken to avoid, minimize, reduce or mitigate impacts to these communities if these populations will be impacted by the proposed project.

Restoration

EPA recommends that the EIS evaluate options for restoration activities following invasive plant removal to prevent their re-establishment.

We recommend including an evaluation of restoring natural processes to assist in the return of stressed natural communities and creating high quality habitats. For example, restoring hydrology to a wetland or riparian site, returning a stream to its natural channel, reintroducing fire, and creating conditions that allow natural processes (large woody debris, carbon storage, nutrient cycling) to occur are all activities that have great potential for restoration success.

Climate Change Effects

EPA recommends that the EIS evaluate whether changes in plant growth, resulting from increased CO_2 in the atmosphere, could affect herbicide efficiency either through uptake rates of the active ingredient or by increased biomass that enables plants to withstand herbicides' effectiveness.

---

[1] EPA's *Consideration of Cumulative Impacts in EPA Review of NEPA Documents* is located at http://www.epa.gov/compliance/resources/policies/nepa/cumulative.pdf

We also recommend that the EIS quantify the greenhouse gas emissions from the project activities and discuss mitigation measures to reduce emissions.

Monitoring

We recommend that the proposed project be designed to include an effective feedback element, which includes both implementation and effectiveness monitoring.

Specifically, it is recommended that the EIS include information and assurances regarding adequate monitoring and evaluation to determine if application rates are effective, buffers are sufficient, off-target drift is minimized, and specific goals and endpoints are being met. We recommend there be a commitment in using the best available techniques for monitoring, evaluating, and mitigating impacts from those herbicides that are known to be persistent and that migrate through soil into groundwater.

Monitoring is a necessary and crucial element in identifying and understanding the consequences of actions. For the proposed project, monitoring would show whether the proposed treatments would be effective in managing invasive plant populations and in minimizing environmental impacts. This information would also be helpful in planning future land management activities.

Other

We recommend the EIS document assess the effects of composting operations and how treated plants will be disposed of (left in place, mulched, composted, etc) particularly those treated with either aminopyralid or fluroxypyr. Aminopyralid and fluroxypyr are in the group of pyridine-based herbicides that have been causing problems in compost. They persist through composting cooperations, and then when the compost is used on sensitive plants, as in right-of-way use, the plants die.

We appreciate the opportunity to review the NOI and look forward to reviewing the draft EIS related to this project. The staff contact for the review is Julie Roemele. She can be reached at (202) 564-5632.

Sincerely,

Susan E Bromm

Susan E. Bromm
Director
Office of Federal Activities

U.S. FISH AND WILDLIFE SERVICE AND NOAA NATIONAL MARINE FISHERIES SERVICE CONSULTATION

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Washington, DC 20240
http://www.blm.gov

MAR 3 2015

In Reply Refer To:
6842 (WO-230)

Memorandum

To: Craig W. Aubrey
Chief, Division of Environmental Review Ecological Services Program

From: Shelley J. Smith
Acting Deputy Assistant Director, Resources and Planning

Subject: Section 7 Consultation for Draft Vegetation Treatments Using Aminopyralid, Fluroxypyr, and Rimsulfuron on the Bureau of Land Management Lands in 17 Western States Programmatic Environmental Impact Statement EIS (PEIS)

The Bureau of Land Management (BLM) is requesting initiation of consultation under the Endangered Species Act (ESA) on the Draft Vegetation Treatments Using Aminopyralid, Fluroxypyr, and Rimsulfuron on the BLM lands in 17 Western States Programmatic Environmental Impact Statement (PEIS). Attached is final Biological Assessment (BA) used to complete the BLM's effects analysis for Threatened, Endangered and Proposed (TEP) species and their designated or proposed critical habitat, pursuant to the ESA, Essential Fish Habitat, and the Magnuson-Stevens Fishery Conservation and Management Act. The analyses in the BA and PEIS incorporate the best scientific and commercial data available to the BLM. The BLM analysis addresses a total of 341 species, subtotaled by species' type below.

Type of Species	Number of Species
Plant	163
Mollusk	11
Arthropod	16
Fish	83
Amphibian	11
Reptile	7
Bird	21
Mammal	29
***Total**	**341**

***Includes subspecies and populations that are treated separately.**

The PEIS assesses, on the national level, the BLM's proposed use of the active ingredients aminopyralid, fluroxypyr, and rimsulfuron. If approved, the BLM will add these three herbicides to the BLM's list of approved active ingredients and integrate them into the BLM Vegetation Management Program. Herbicide treatments using all approved active ingredients would occur on the BLM-administered lands in 17 western states, including Alaska. The prescribed treatments would take place on no more than 932,000 acres annually, which is the same acreage limit that was analyzed in the PEIS and BA released in 2007. The BLM plans to continue to treat vegetation on the BLM-administered lands using an integrated pest management approach, utilizing a variety of vegetation management tools, including herbicides, prescribed fire, and mechanical, manual, and biological control methods. With the exception of the three new herbicides, use of all of the vegetation management tools by the BLM have been previously analyzed at the EIS level and approved through Records of Decision.

As part of the PEIS analysis of herbicide use, ecological risk assessments (ERAs) were prepared by the BLM to assess the risks of these herbicides to fish and wildlife, including TEP species and their designated or proposed critical habitat. The ERA methodology was developed in collaboration with the U.S. Fish and Wildlife Service, National Marine Fisheries Service, and the Environmental Protection Agency for the 2007 PEIS and BA.

During development of the current PEIS and BA, standard operating procedures (SOPs) and conservation measures were developed to minimize potential effects to plants and animals from treatments using aminopyralid, fluroxypyr, and rimsulfuron. SOPs and conservation measures specific to TEP species and their designated or proposed critical habitat are included in the BA. Additionally, the BLM would continue to follow all SOPs and conservation measures identified in the 2007 PEIS and BA. These measures are conservative and designed to apply across all public lands. During project planning, local field offices have the opportunity to identify additional appropriate local SOPs and conservation measures to reduce further potential effects at the project scale. All subsequent actions implemented are subject to the National Environmental Policy Act analysis and consultation under the ESA, if it is determined that they "May Affect" TEP species and/or their designated or proposed critical habitat.

The BLM's proposed use of the active ingredients aminopyralid, fluroxypyr, and rimsulfuron would require field offices to comply with all SOPs and conservation measures contained in the PEIS, BA and in the ERAs for TEP species and their designated or proposed critical habitat that could be affected by a site-specific proposed action. The proposed action also requires consultation at the project-level if it is determined that the project actions "May Affect" a TEP species or their designated or proposed critical habitat.

The scale of the proposed action is the 17 states evaluated in the PEIS. Although herbicide treatments using the three new herbicides could occur anywhere on the 245 million acres of public lands administered by the BLM; actual treatment locations and levels are determined by Congressional direction and funding. With current funding levels, the BLM is treating an average of 315,000 acres per year using herbicides (about one tenth of one percent of BLM-administered lands). For the purposes of evaluating the effects of herbicide treatments with

aminopyralid, fluroxypyr, and rimsulfuron on TEP species and/or their designated or proposed critical habitat, the estimate of 932,000 acres treated annually using all herbicides (about four tenths of one percent of BLM-administered lands) was carried over from the 2007 PEIS.

Outside of one, no effect determination found on a fish species within the federal mineral estate, the BLM has determined, through the effects analysis that the proposed action may affect but is **Not Likely to Adversely Affect** all species analyzed in the BA. The effects determination assumes that the BLM will protect TEP species through the use of conservation measures identified for various species groups in the 2007 and current BA, additional conservation measures developed by local field offices (primarily for spot treatments near TEP plants), and SOPs identified in the 2007 and current PEIS. Subsequent site-level actions that do not conform to these standards may not result in a determination of **Not Likely to Adversely Affect**. Regardless, all subsequent actions remain subject to consultation if a "May Affect" determination is made at the local level.

The BLM appreciates the opportunity to work with you and your staff to clarify the information about the PEIS and the consultation. If you have any questions regarding the PEIS, please contact Gina Ramos, Division of Forest, Riparian, and Rangeland Resources (WO-220) at (202) 912-7226. If you have any questions regarding consultation or essential fish habitat, please contact Kim Tripp, Senior Specialist, Threatened, and Endangered Species Program (WO-230) at (202) 912-7237.

Attachment

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Washington, DC 20240
http://www.blm.gov

MAR 3 2015

In Reply, Refer To:
6842 (WO-230)

Donna Wieting
Director, Office of Protected Resources (F/PR)
National Marine Fisheries Service
1315 East-West Highway
Silver Spring, MD 20910

Dear Ms. Wieting:

The Bureau of Land Management (BLM) is requesting initiation of consultation under the Endangered Species Act (ESA) on the Draft Vegetation Treatments Using Aminopyralid, Fluroxypyr, and Rimsulfuron on BLM lands in 17 Western States Programmatic Environmental Impact Statement (PEIS). Please find enclosed, the final Biological Assessment (BA) used to complete the BLM effects analysis for Threatened, Endangered, and Proposed (TEP) species and their designated critical habitat, pursuant to the ESA, and Essential Fish Habitat pursuant to the Magnuson-Stevens Fishery Conservation and Management Act (MSA). The analyses in the BA and PEIS incorporate the best scientific and commercial data available to the BLM.

The BLM analysis addresses a total of 341 species, subtotaled by species' type below.

Type of Species	Number of Species
Plant	163
Mollusk	11
Arthropod	16
Fish	83
Amphibian	11
Reptile	7
Bird	21
Mammal	29
***Total**	**341**

***Includes subspecies and populations that are treated separately.**

The PEIS assesses, on the national level, the BLM's proposed use of the active ingredients aminopyralid, fluroxypyr, and rimsulfuron. If approved, the BLM will add these three herbicides to its list of approved active ingredients and integrate them into the BLM Vegetation Management

Program. Herbicide treatments using all approved active ingredients would occur on BLM-administered lands in 17 western states, including Alaska. The prescribed treatments would take place on no more than 932,000 acres annually, which is the same acreage limit that was analyzed in the PEIS and BA released in 2007. The BLM plans to continue to treat vegetation on the BLM administered lands using an integrated pest management approach, utilizing a variety of vegetation management tools, including herbicides, prescribed fire, and mechanical, manual, and biological control methods. With the exception of the three new herbicides, use of all of the vegetation management tools by the BLM have been previously analyzed at the EIS level and approved through Records of Decision.

As part of the PEIS analysis of herbicide use, ecological risk assessments (ERAs) were prepared by the BLM to assess the risks of these herbicides to fish and wildlife, including TEP species and their designated or proposed critical habitat. The risk assessment methodology was developed in collaboration with the U.S. Fish and Wildlife Service, National Marine Fisheries Service (NMFS), and the U.S. Environmental Protection Agency for the 2007 PEIS and BA.

During development of the current PEIS and BA, standard operating procedures (SOPs) and conservation measures were developed to minimize potential effects to plants and animals from treatments using aminopyralid, fluroxypyr, and rimsulfuron. SOPs and conservation measures specific to TEP species are included in the BA. Additionally, the BLM would continue to follow all SOPs and conservation measures identified in the 2007 PEIS and BA. These measures are conservative and designed to apply across all public lands. During project planning, local field offices have the opportunity to identify additional appropriate local SOPs and conservation measures to reduce further potential effects at the project scale. All subsequent actions implemented are subject to the National Environmental Policy Act analysis and consultation under the ESA, if it is determined that they "May Affect" TEP species or their designated or proposed critical habitat.

The BLM's proposed use of the active ingredients aminopyralid, fluroxypyr, and rimsulfuron would require field offices to comply with all SOPs and conservation measures provided in the PEIS, BA, ERAs for TEP species, and their designated or proposed critical habitat that could be affected by a site-specific herbicide treatment project. The proposed action also requires consultation at the project-level if it is determined that the project actions "May Affect" TEP species or their designated or proposed critical habitat.

The scale of the proposed action is the 17 states evaluated in the PEIS. Although herbicide treatments using the three new herbicides could occur anywhere on the 245 million acres of public lands administered by the BLM; actual treatment locations and levels are determined by Congressional direction and funding. With current funding levels, the BLM is treating an average of 315,000 acres per year (about one-tenth of one percent of BLM-administered lands) using herbicides. For the purposes of evaluating the effects of herbicide treatments with aminopyralid, fluroxypyr, and rimsulfuron on TEP species and their designated or proposed critical habitat, the estimate of 932,000 acres treated annually using all herbicides (about four tenths of one percent of BLM-administered lands) was carried over from the 2007 PEIS.

The proposed action does not fund or carryout any subsequent program or on-the-ground action that could cause a direct or indirect effect to TEP species or their designated or proposed critical habitat.

Subsequent decisions which authorize, fund or carry out actions that may affect TEP species or their designated or proposed critical habitat, or result in adverse effects to Essential Fish Habitat (EFH), will be subject to consultation at the local level.

Outside of one, no effect determination found on a fish species within the federal mineral estate, the BLM has determined, through the effects analysis that the proposed action may affect but is Not Likely to Adversely Affect all species analyzed in the BA. The effects determination assumes that the BLM will protect TEP species through the use of conservation measures identified for various species groups in the 2007 and current BA, additional conservation measures developed by local field offices (primarily for spot treatments near TEP plants), and SOPs identified in the 2007 and current PEIS. Subsequent site-level actions that do not conform to these standards may not result in a determination of Not Likely to Adversely Affect. Regardless, all subsequent actions remain subject to consultation if a "May Affect" determination is made at the local level.

The BLM conducted an analysis of potential impacts to EFH in the BA and concluded the proposed action does not adversely affect EFH (it does not fund, authorize, or undertake any on-the-ground actions that could impact EFH). Consultation under MSA on EFH is not required for actions which would not cause an adverse effect (50 CFR 600.920). If, based on the information contained in the administrative record, NMFS disagrees with our finding, NMFS may issue advisory conservation recommendations if you conclude there are adverse effects. Per the NMFS policy and guidelines, actions subject to ESA consultation which are determined to be NLAA, by definition do not cause an adverse impact to EFH. This proposed action creates a common standard for project or site-level implementation regardless of the presence of ESA-listed species or presence of EFH.

Thank you for the productive meeting and agreeing to initiate consultation. If you have any questions regarding the PEIS, please contact Gina Ramos, Division of Forest, Riparian, and Rangeland Resources (WO-220) at (202) 912-7226. If you have any questions regarding consultation or essential fish habitat, please contact Kim Tripp, Senior Specialist, Threatened, and Endangered Species Program (WO-230) at (202) 912-7237. The BLM looks forward to completing this programmatic consultation in an expeditious manner and as close to the time frames defined by the regulations as possible, given no further delays.

Sincerely,

Shelley J. Smith
Acting Deputy Assistant Director
Resources and Planning

Enclosure

APPENDIX C

ALASKA NATIONAL INTEREST LANDS CONSERVATION ACT (ANILCA) § 810 ANALYSIS OF SUBSISTENCE IMPACTS

APPENDIX C

ALASKA NATIONAL INTEREST LANDS CONSERVATION ACT (ANILCA) § 810 ANALYSIS OF SUBSISTENCE IMPACTS

Introduction

On December 21, 2012, the United States Department of the Interior (USDOI) Bureau of Land Management (BLM) issued a Notice of Intent in the Federal Register to prepare a Programmatic Environmental Impact Statement (PEIS) to evaluate the viability of using aminopyralid, fluroxypyr, and rimsulfuron herbicides as part of BLM vegetation management programs in 17 western states, including Alaska. A total of 18 herbicides were approved for use on public lands under the 2007 *Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in 17 Western States Programmatic Environmental Impact Statement* (2007 PEIS; USDOI BLM 2007a). If approved for use under the current project, the three new herbicides will join the list of EIS-approved herbicides currently in use on BLM lands, bringing the total to 21.

The Notice of Intent for the PEIS identified the locations and times of public scoping meetings, and stated that comments on the proposal would be accepted until February 19, 2013. Information gathered at the public meetings and during the comment period led to the development of the *Draft Vegetation Treatments Using Aminopyralid, Fluroxypyr, and Rimsulfuron on Bureau of Land Management Lands in 17 Western States PEIS*. This document assesses on a national level the BLM's proposed use of aminopyralid, fluroxypyr, and rimsulfuron. Together with the 2007 PEIS, it addresses the BLM's herbicide treatment programs on the 17 western states, including Alaska. Because of the programmatic nature of herbicide use by the BLM, the two documents address a wide range of impacts that are inclusive of the extensive and diverse land area under analysis. Should herbicide use be proposed locally, then site-specific impacts of all vegetation treatments would be addressed and analyzed in additional NEPA documents prepared by local BLM offices and tiered to the PEIS documents.

BLM-administered lands (public lands) are federally owned lands and interests in lands (such as federally owned mineral estate) that are administered by the Secretary of the Interior through the BLM. In Alaska, public lands also include lands selected, but not yet conveyed, to the State of Alaska or Native Corporations and villages.

Chapters 3 (Affected Environment) and 4 (Environmental Consequences) of the PEIS provide detailed descriptions of the affected environment and the potential effects of the various alternatives on subsistence resources, with information in the 2007 PEIS referenced where appropriate. This appendix uses the detailed information presented in the PEIS to evaluate the potential impacts to subsistence pursuant to Section 810(a) of the Alaska National Interest Land Conservation Act (ANILCA).

Subsistence Evaluation Factors

Section 810(a) of ANILCA requires that an evaluation of subsistence uses and needs be completed for any federal determination to "withdraw, reserve, lease, or otherwise permit the use, occupancy or disposition of public lands." As such, an evaluation of potential impacts to subsistence under ANILCA § 810(a) must be completed for the PEIS. ANILCA requires that this evaluation include findings on three specific issues:

- The effect of use, occupancy, or disposition on subsistence uses and needs;
- The availability of other lands for the purpose sought to be achieved; and
- Other alternatives that would reduce or eliminate the use, occupancy, or disposition of public lands needed for subsistence purposes (16 United States Code § 3120).

A finding that the proposed action may significantly restrict subsistence uses imposes additional requirements, including provisions for notices to the State of Alaska and appropriate regional and local subsistence committees, a hearing in the vicinity of the area involved, and the making of the following determinations, as required by Section 810(a)(3):

- Such a significant restriction of subsistence uses is necessary, and consistent with sound management principles for the utilization of the public lands;
- The proposed activity will involve the minimal amount of public lands necessary to accomplish the purposes of use, occupancy, or other disposition; and
- Reasonable steps will be taken to minimize adverse effects upon subsistence uses and resources resulting from such actions.

To determine if a significant restriction of subsistence uses and needs may result from any one of the alternatives discussed in the PEIS, including their cumulative effects, the following three factors in particular are considered:

- Reductions in the availability of subsistence resources caused by a decline in the population or amount of harvestable resources;
- Reductions in the availability of resources used for subsistence purposes caused by alteration of their normal locations and distribution patterns; and
- Limitations on access to subsistence resources, including limitations resulting from increased competition for the resources.

Evaluation of Alternatives and Findings

The alternatives presented below are associated with a decision about whether to allow the BLM to use the herbicides aminopyralid, fluroxypyr, and rimsulfuron on public lands in the western U.S. and Alaska. All of the alternatives involve herbicide treatments on the same number of total acres, with differences in how much of each herbicide would be used annually. No specific projects are proposed under any of the alternatives. When a project is proposed, the BLM will be required to initiate a site-specific National Environmental Policy Act analysis of the proposed actions. For lands covered under the ANILCA, the BLM would also conduct an additional ANILCA § 810 Analysis of Subsistence Impacts. During this process, the BLM will invite public participation and collaborate with Alaska Natives to identify and protect culturally significant plants used for food, baskets, fiber, medicine and ceremonial purposes. For this document, the evaluation and findings required by ANILCA § 810 are similar for all four alternatives considered in the PEIS, primarily because of the programmatic nature of the proposed herbicide use, and because there is no difference in location or amount of total herbicide use among the alternatives. The BLM has found that none of the alternatives in the PEIS result in a finding of "may significantly restrict subsistence uses and needs."

A subsistence evaluation and finding under ANILCA § 810 must also include a cumulative impacts analysis. The discussion below begins with evaluations and findings for each of the four alternatives discussed in the PEIS. Finally, the cumulative case, as discussed in Chapter 4 (Environmental Consequences) of the PEIS, is evaluated. This approach helps the reader to separate the subsistence restrictions that would potentially be caused by activities proposed under the alternatives from those that would potentially be caused by past, present, and future activities that could occur, or have already occurred, under the vegetation management program.

ANILCA § 810(a) Evaluations and Findings for All Alternatives and the Cumulative Case

The following evaluations are based on information relating to the environmental and subsistence consequences of alternatives A through D and the cumulative impacts analysis as presented in Chapter 4 (Environmental Consequences) of the PEIS. The evaluations and findings focus on potential impacts to subsistence resources themselves, as well as access to resources, and economic and cultural issues that relate to subsistence use.

Evaluation and Findings for Alternative A - Continue Present Herbicide Use (No Action Alternative)

Under this alternative, the BLM would continue current vegetation management activities in Alaska with the 18 herbicides approved for use in the Record of Decision for the 2007 PEIS (currently approved herbicides). This alternative represents the Preferred Alternative of the 2007 PEIS.

Approximately 932,000 acres would be treated with herbicides annually across 17 western states. It is estimated that no more than 1,000 acres of public lands in Alaska would be treated with herbicides in any year. Since the release of the 2007 PEIS, 0 acres in Alaska have been treated using herbicides, although some herbicide use has been proposed in association with future projects to limit the spread of invasive species from disturbed sites into more pristine areas.

Only herbicides that are registered for use in Alaska would be applied in the state. At present, 15 of the 18 currently approved herbicide active ingredients are registered for use in Alaska, although the list includes only certain formulations of the registered active ingredients. This list is available from the Alaska Department of Environmental Quality.

All herbicide treatments would be guided by Standard Operating Procedures (SOPs) that serve to protect habitat and resources from potential impacts. Standard Operating Procedures pertaining to herbicide application are found in Chapter 2 of the 2007 PEIS (USDOI BLM 2007a:Table 2-8). Additional mitigation measures that were developed to protect various resources can be found in the Record of Decision for the 2007 PEIS (USDOI BLM 2007b:Table 2). There is concern in Alaska about the use of herbicides in sensitive environments, including tundra and boreal forests, but herbicide use may be appropriate where impacts to soil and other resources are negligible, and where other treatment methods do not provide adequate vegetation control (Hebert 2001).

Evaluation of the Effect of Use, Occupancy, or Disposition on Subsistence Uses and Needs

In Alaska, use of herbicides would have both beneficial and adverse effects. Herbicides would be used to eliminate or reduce the extent of infestations of invasive vegetation, which could help restore ecosystem function to the benefit of subsistence resources. The *Dalton Management Area Integrated Invasive Plant Strategic Plan Environmental Assessment* (USDOI BLM 2013), which incorporates a draft of the strategic plan (USDOI BLM 2009), proposes use of herbicides to control invasive plants along the Dalton Highway and adjacent BLM-administered lands along trails and spur roads, and at other heavy use areas (e.g., gravel pits, rest stops, mine sites, and airstrips). The intent of the herbicide treatments is to stop the spread of invasive plants from disturbed sites into the more pristine areas. Prevention of weed spread into these areas would be expected to help protect subsistence resources from the ecological changes caused by invasive plant species. For example nitrogen fixing weeds (white sweetclover, alfalfa, birdsfoot trefoil and birdsfoot) have the risk of altering ecosystem processes and wildlife habitats by introducing nitrogen into naturally nitrogen-poor habitats.

Herbicide treatments are expected to have short-term adverse and long-term beneficial effects. Undesirable impacts from herbicide use could include: 1) overspray onto non-target species that would result in injury or death of plants; 2) accidental spills that could kill non-target plants and run into wetlands or streams; 3) herbicide drift from the application site that could damage plants; and 4) toxicity to organisms, including people, from excessive contact or ingestion. The BLM has developed SOPs to minimize the adverse effects of herbicide treatments. Part of the NEPA process for vegetation treatments is consultation with Native groups and the public to determine the location of important subsistence resources that might be affected by herbicide treatments, in order to minimize or eliminate the undesirable impacts of the treatments. The BLM would work closely with subsistence users to minimize impacts to subsistence resources in particular, and would follow guidance under Human Health and Safety in Chapter 4 of the 2007 PEIS in areas that may be visited by people after treatments.

If necessary for the protection of subsistence plants and wildlife forage, the BLM would: 1) use drift reduction agents with herbicides, as appropriate, to reduce the drift hazard to non-target species; 2) refer to the herbicide label when planning revegetation to ensure that desirable vegetation would not subsequently be injured by the herbicide; and 3) consider site characteristics, environmental conditions, and application equipment in order to minimize damage to non-target vegetation. To protect fish and wildlife, the BLM would: 1) use buffer zones based on label and risk assessment guidance; 2) minimize treatments near

fish-bearing water bodies during periods when fish are in life stages most sensitive to the herbicide(s) used; 3) use appropriate application equipment/methods near water bodies if the potential for off-site drift exists; 4) use herbicides that are the least toxic to fish; 5) treat only the portion of the aquatic system necessary to achieve acceptable vegetation management; 6) select the appropriate application method(s) to minimize the potential for injury to desirable vegetation and aquatic organisms; 7) follow water use restrictions presented on the herbicide label; 8) minimize treatments during nesting and other critical periods for birds and other wildlife; and 9) use herbicides of low toxicity to wildlife.

To protect water resources, the BLM would: 1) consider climate, soil type, slope, and vegetation type when determining contamination risk; 2) conduct mixing and loading operations in an area where an accidental spill would not contaminate an aquatic body; 3) refrain from rinsing spray tanks in or near water bodies; 4) refrain from broadcasting pellets where there is danger of contaminating water supplies; 5) minimize treating areas with high risk for groundwater contamination; 6) maintain herbicide-free buffers between treatment areas and water bodies; and 7) use the appropriate herbicide-free buffer zone for herbicides not labeled for aquatic use based on risk assessment guidance, with minimum widths of 100 feet for aerial, 25 feet for vehicle, and 10 feet for hand spray applications.

Evaluation of the Availability of Other Lands for the Purpose Sought to be Achieved

The purpose sought to be achieved under the No Action Alternative is to continue to manage public lands to prevent the spread and establishment of invasive non-native plants and to reduce hazards caused by excessive fuel loads. The lands that would be selected for weed control or fuels reduction treatments include areas on public lands in Alaska where invasive plants occur and areas with an abundance of fire fuels that increase the likelihood of catastrophic fire. The objective of treatments is to restore land health. In the future, areas of proposed treatment would be prioritized and analyzed under an appropriate NEPA document. Given that the BLM would propose future treatments on public lands only, other lands would not be available for the purpose. Lands administered by other federal agencies in Alaska are directed by their own planning documents. State- and Native Corporation-administered lands cannot be considered in a BLM plan, and under BLM policy other public lands outside of Alaska are not considered under ANILCA.

Evaluation of Other Alternatives that would Reduce or Eliminate the Use, Occupancy, or Disposition of Public Lands Needed for Subsistence Purposes

Other alternatives pertaining to use of herbicides on public lands needed for subsistence include the action alternatives, which are presented and analyzed in Chapters 2 and 4 of the main body of the PEIS. These alternatives were developed based on the alternatives in the 2007 PEIS, and address many of the concerns raised during scoping for the 2007 PEIS and for this PEIS, including risks associated with aerial spraying and use of acetolactate synthase (ALS) inhibiting active ingredients. These alternatives represent a range of options for feasibly attaining or approximating the BLM's objectives for herbicide use, as expressed in its programs, policies, and land use plans.

Findings

The No Action Alternative would not significantly restrict subsistence use in Alaska. Although no herbicide treatments under the vegetation management program have occurred in Alaska to date, some herbicide use is proposed for the future. For all future projects, individual, site-specific NEPA analysis is required prior to implementing the project. In this way, the BLM would be able to define with local input what SOPs and mitigation measures would be required to prevent damage to subsistence plants and animals. When projects are proposed, local communities would be given the opportunity to participate in the planning process and assist with the design of proposed treatments. The No Action Alternative also includes all of the SOPs and mitigation measures from the 2007 PEIS that have been developed to minimize impacts to resources and human health. Over the long term, actions to reduce the spread of invasive plants and reduce wildfire risk would likely benefit subsistence resources.

Evaluation and Finding for Alternative B - Allow for Use of Three New Herbicides in 17 Western States (Preferred Alternative)

Alternative B, the Preferred Alternative, would allow the BLM to use aminopyralid, fluroxypyr, and rimsulfuron, in addition to the 18 currently approved active ingredients, in its herbicide treatment programs. Under this alternative, as under the other alternatives, total projected acreage of herbicide treatments on public lands in 17 western states is 932,000 acres annually. Within Alaska, it is estimated that no more than 1,000 acres of public lands would be treated with herbicides in any given year. Only herbicides that are registered for use in Alaska would be applied in the state. Formulations of aminopyralid, fluroxypyr, and rimsulfuron are registered in Alaska, so all three could be used in the state.

All herbicide treatments would be guided by SOPs that serve to protect habitat and resources from potential impacts, as well as mitigation measures developed for the currently approved herbicides, which can be found in the 2007 PEIS and the associated Record of Decision. Additionally, all of the mitigation developed for use of the three new herbicides would be followed, as applicable. This mitigation is presented in Table 2-5 of the PEIS.

Evaluation of the Effect of Use, Occupancy, or Disposition on Subsistence Uses and Needs

Potential effects to subsistence resources under the Preferred Alternative would be similar to those under the No Action Alternative. There would be no difference between the alternatives as far as the goals of herbicide treatments or the land areas affected, although the mix of herbicides used could be different. Use of herbicides would have both beneficial and adverse effects, with a potential long-term benefit of reducing or eliminating target infestations of invasive plant species.

Plants, fish, and wildlife used for subsistence could be adversely affected by herbicide treatments. It is assumed that non-target plants could be impacted by treatments utilizing any of the active ingredients, although the species impacted and level of effect would vary by active ingredient used. Herbicide treatments could temporarily displace wildlife, and could result in toxicological impacts to fish and wildlife. Toxicological risks would vary based on the active ingredients used. All three of the new active ingredients are of lower risk to fish and wildlife than nearly all of the other active ingredients currently approved for use. Additionally, use of the currently approved herbicides with the greatest risk to fish and wildlife would decrease under this alternative, relative to the No Action Alternative. Therefore, toxicological risks to fish and wildlife could also be lower under this alternative, depending on which herbicides were selected for use in Alaska in the future.

Evaluation of the Availability of Other Lands for the Purpose Sought to be Achieved

Just like under the No Action Alternative, the lands that would be selected for weed control or fuels reduction treatments include areas on public lands in Alaska where invasive plants occur and areas with an abundance of fire fuels that increase the likelihood of catastrophic fire. Future treatments would occur on public lands only; other lands would not be available for this purpose and could not be considered by the BLM.

Evaluation of Other Alternatives that would Reduce or Eliminate the Use, Occupancy, or Disposition of Public Lands Needed for Subsistence Purposes

Other alternatives that would define the types of vegetation management actions allowed on public lands needed for subsistence include the other action alternatives, and No Action Alternative, which are presented and analyzed in Chapters 2 and 4 of the main body of the PEIS. These alternatives represent a range of options for feasibly attaining or approximating the BLM's objectives for herbicide use, as expressed in its programs, policies, and land use plans.

Findings

The Preferred Alternative would not significantly restrict subsistence use in Alaska. Although no herbicide treatments under the vegetation management program have occurred in Alaska to date, some herbicide use is proposed for the future. For all future projects, individual, site-specific NEPA analysis is required prior to implementing the project. In this way, the BLM would be able to define with local input what SOPs and mitigation measures would be required to prevent damage to subsistence plants and animals. When projects are proposed, local communities would be given the opportunity to participate in the planning process and assist with the design of proposed treatments. The Preferred Alternative includes all of

the SOPs and mitigation measures from the 2007 PEIS that have been developed to minimize impacts to resources and human health. It also includes additional mitigation measures for aminopyralid, fluroxypyr, and rimsulfuron from the current PEIS to minimize impacts to resources and human health associated with these active ingredients. Over the long term, actions to reduce the spread of invasive plants and reduce wildfire risk would likely benefit subsistence resources.

Evaluation and Findings for Alternative C – No Aerial Application of New Herbicides

Alternative C, the No Aerial Application of New Herbicides Alternative, would allow the BLM to use aminopyralid, fluroxypyr, and rimsulfuron, in addition to the 18 currently approved active ingredients, in its herbicide treatment programs. However, only ground applications of the new herbicides would be permitted; aerial applications of aminopyralid, fluroxypyr, and rimsulfuron would be prohibited. Under this alternative, as under the other alternatives, total projected acreage of herbicide treatments on public lands in 17 western states is 932,000 acres annually. Within Alaska, it is estimated that no more than 1,000 acres of public lands would be treated with herbicides in any given year.

Evaluation of the Effect of Use, Occupancy, or Disposition on Subsistence Uses and Needs

Potential effects to subsistence resources under Aternative C would be similar to those under the other alternatives. There would be no difference among the alternatives as far as the goals of herbicide treatments or the land areas affected, although the mix of herbicides used could be different. And while aminopyralid, fluroxypyr, and rimsulfuron would only be applied using ground methods, other active ingredients could be applied aerially. Use of herbicides would have both beneficial and adverse effects, with a potential long-term benefit of reducing or eliminating target infestations of invasive plant species.

Similar to the other alternatives, non-target plants, fish, and wildlife used for subsistence could be adversely affected by herbicide treatments. Wildlife could be temporarily displaced from treatments sites, and fish and wildlife could be subject to toxicological risks associated with exposure to herbicides. Impacts to fish and wildlife would vary depending on the type of fish or wildlife exposed to the treatment, the type of exposure, and the active ingredient(s) used. Aminopyralid, fluroxypyr, and rimsulfuron have a lower toxicological risk to fish and wildlife than many of the currently approved herbicides, so this alternative would allow the BLM more opportunities than at present to select active ingredients that do not harm fish and wildlife, depending on the treatment needs.

Evaluation of the Availability of Other Lands for the Purpose Sought to be Achieved

Just like under the other alternatives, the lands that would be selected for weed control or fuels reduction treatments include areas on public lands in Alaska where invasive plants occur and areas with an abundance of fire fuels that increase the likelihood of catastrophic fire. Future treatments would occur on public lands only; other lands would not be available for this purpose and could not be considered by the BLM.

Evaluation of Other Alternatives that would Reduce or Eliminate the Use, Occupancy, or Disposition of Public Lands Needed for Subsistence Purposes

Other alternatives that would define the types of vegetation management actions allowed on public lands needed for subsistence include the other action alternatives and the No Action Alternative, which are presented and analyzed in Chapters 2 and 4 of the main body of the PEIS. These alternatives represent a range of options for feasibly attaining or approximating the BLM's objectives for herbicide use, as expressed in its programs, policies, and land use plans.

Findings

Alternative C would not significantly restrict subsistence use in Alaska. Although no herbicide treatments under the vegetation management program have occurred in Alaska to date, some herbicide use is proposed for the future. For all future projects, individual, site-specific NEPA analysis is required prior to implementing the project. In this way, the BLM would be able to define with local input what SOPs and mitigation measures would be required to prevent damage to subsistence plants and animals. When projects are proposed, local communities would be given the opportunity to participate in the planning process and assist with the design of proposed treatments. Alternative C includes all of the SOPs and mitigation measures from the 2007 PEIS that have been developed to minimize impacts to resources and

human health. It also includes additional mitigation measures for aminopyralid, fluroxypyr, and rimsulfuron from the current PEIS (Table 2-5) to minimize impacts to resources and human health associated with these active ingredients. Over the long term, actions to reduce the spread of invasive species and reduce wildfire risk would likely benefit subsistence resources.

Evaluation and Findings for Alternative D – No Use of NewAcetolactate Synthase-inhibiting Active Ingredients (No Rimsulfuron)

Alternative D, the No Use of New Acetolactate Synthase-inhibiting Herbicides alternative, would allow the BLM to use aminopyralid and fluroxypyr, in addition to the 18 currently approved active ingredients, in its herbicide treatment programs. Rimsulfuron, however, would not be added to the list of approved active ingredients. Under this alternative, as under the other alternatives, total projected acreage of herbicide treatments on public lands in 17 western states is 932,000 acres annually. Within Alaska, it is estimated that no more than 1,000 acres of public lands would be treated with herbicides in any given year.

Evaluation of the Effect of Use, Occupancy, or Disposition on Subsistence Uses and Needs

Under Alternative D, potential effects to subsistence resources would be similar to those under the other alternatives. There would be no difference among the alternatives as far as the goals of herbicide treatments or the land areas affected, although the mix of herbicides used could be different. Use of herbicides would have both beneficial and adverse effects, with a potential long-term benefit of reducing or eliminating target infestations of invasive plant species.

Similar to the other alternatives, non-target plants, fish, and wildlife used for subsistence could be adversely affected by herbicide treatments. Wildlife could be temporarily displaced from treatments sites, and fish and wildlife could be subject to toxicological risks associated with exposure to herbicides. Impacts to fish and wildlife would vary depending on the type of fish or wildlife exposed to the treatment, the type of exposure, and the active ingredient(s) used. Aminopyralid and fluroxypyr have a lower toxicological risk to fish and wildlife than many of the currently approved herbicides, so this alternative would allow the BLM more opportunities than at present to select active ingredients that do not harm fish and wildlife, depending on the treatment needs. However, the number of new lower risk herbicides available would be less than under the other action alternatives.

Evaluation of the Availability of Other Lands for the Purpose Sought to be Achieved

Just like under the other alternatives, the lands that would be selected for weed control or fuels reduction treatments include areas on public lands in Alaska where invasive non-native plants occur and areas with an abundance of fire fuels that increase the likelihood of catastrophic fire. Future treatments would occur on public lands only; other lands would not be available for this purpose and could not be considered by the BLM.

Evaluation of Other Alternatives that would Reduce or Eliminate the Use, Occupancy, or Disposition of Public Lands Needed for Subsistence Purposes

Other alternatives that would define the types of vegetation management actions allowed on public lands needed for subsistence include the other action alternatives and the No Action Alternative, which are presented and analyzed in Chapters 2 and 4 of the main body of this PEIS. These alternatives represent a range of options for feasibly attaining or approximating the BLM's objectives for herbicide use, as expressed in its programs, policies, and land use plans.

Findings

Alternative C would not significantly restrict subsistence use in Alaska. Although no herbicide treatments under the vegetation management program have occurred in Alaska to date, some herbicide use is proposed for the future. For all future projects, individual, site-specific NEPA analyses is required prior to implementing the project. In this way, the BLM would be able to define with local input what SOPs and mitigation measures would be required to prevent damage to subsistence plants and animals. When projects are proposed, local communities would be given the opportunity to participate in the planning process and assist with the design of proposed treatments. Alternative D includes all of the SOPs and mitigation measures from the 2007 PEIS that have been developed to minimize impacts to resources and human health. It also includes additional mitigation measures for aminopyralid and fluroxypyr from the current PEIS (Table 2-5) to minimize impacts to resources and human health associated with these

active ingredients. Over the long term, actions to reduce the spread of invasive plant species and reduce wildfire risk would likely benefit subsistence resources.

Evaluation and Findings for the Cumulative Case

The Cumulative Case, as presented within the Cumulative Effects Analysis in Chapter 4 of the PEIS, is a discussion of impacts that could affect the management decisions contained within Alternatives A through D. The cumulative effects analysis in the PEIS is based on the analysis in the 2007 PEIS, which was completed for the BLM's vegetation management program, and which includes herbicide treatments as well as other treatment methods. Since the three new herbicides would be added to an existing program, with no change in program goals or in acres or areas treated, much of the 2007 analysis is inclusive of their use.

The analysis of cumulative impacts is a four-step process that follows guidance provided in *Considering Cumulative Effects Under the National Environmental Policy Act* (Council on Evironmental Quality [CEQ] 1997):

- **Specify the class of actions of which effects are to be analyzed.**

The PEIS cumulative effects analysis considers large, regional scale trends and issues that require integrated management across broad landscapes, and regional-scale trends and changes in the social and economic needs of people.

Potential cumulative effects include those assessed for all land ownerships, including lands administered by other federal agencies and non-federal lands, particularly effects on air quality and terrestrial and aquatic species. The analysis and disclosure of cumulative effects alerts decision-makers and the public to the context within which effects are occurring, and to the environmental implications of the interactions of known and likely management activities. During subsequent analyses for site-specific activities, local cumulative effects should be important considerations in the design of site-specific alternatives and mitigation measures.

- **Designate the appropriate time and space domain in which the relevant actions occur**.

The analysis period covered by the cumulative effects analysis primarily begins in the 1930s with the passage of the Taylor Grazing Act, and continues through 2057.

For purposes of this analysis, the spatial domain for past, present, and reasonably foreseeable activities is primarily the 17 western states evaluated in the PEIS.

- **Determine the magnitude of effects on the receptors and whether those effects are accumulating.**

The set of receptors assessed in the cumulative effects analysis are the physical, biological, and human systems discussed in Chapter 3 (Affected Environment).

The potential extent of the total cumulative effects (e.g., number of animals and habitat affected), and how long the effects might last (e.g., population recovery time), are estimated to determine the magnitude of effects that could accumulate for each resource. Where possible, the assessment of effects on a resource is based on quantitative analysis (e.g., level of risk to humans from use of an herbicide). However, many effects are difficult to quantify (e.g., animal behaviors; human perceptions) and a qualitative assessment of effects is made.

The purpose of the analysis of cumulative effects in the PEIS is to determine whether the effects are additive or synergistic or have some other relationship. Additive (or combined) effects on specific resources often are difficult to detect and do not necessarily add up in the strict sense of one plus one equals two. It is much more likely that an additive or combined effect would be greater than one but less than two. A synergistic effect, in theory, is a total effect that is greater than the sum of the additive effects on a resource. To arrive at a synergistic effect in this example (continuing with the numeric analogy), the total cumulative effect would need to end up greater than two. In the highly variable western U.S. environment, where natural variations in population levels can exceed the impacts of human activity, such an effect would need to be much greater than the hypothetical two to be either measurable or noteworthy. A countervailing effect occurs when an impact has both adverse and beneficial effects. For example, herbicide treatments would harm or destroy vegetation used by some species of wildlife (adverse effect), but would improve overall ecosystem health

that would lead to improved watershed conditions and habitat for other wildlife (beneficial effect).

Resource analysts have tried to keep the cumulative analysis useful, manageable, and concentrated on meaningful potential effects. The cumulative analysis considers in greatest detail activities that are more certain to happen and that are geographically in or near public lands, and activities identified during scoping as being of greatest concern. The guiding principles from existing standards, criteria, and policies that control management of the natural resources of concern have been used to help focus the analysis. For areas where existing standards, criteria, and policies are not available, the resource experts used their best judgment to focus the analysis.

Evaluation of the Effect of Such Use, Occupancy, or Disposition on Subsistence Uses and Needs

The PEIS Cumulative Effects Analysis in Chapter 4 does not include a specific section on subsistence. The following information is from the wildlife, fish, and vegetation sections, since subsistence resources fall into these categories.

Since the same number of acres would be treated with herbicides under all of the alternatives considered in the PEIS, there would be similar effects to subsistence resources under all of the alternatives. Differences would be limited to the relative amount of use of various herbicides. Therefore, cumulative effects would be similar under all the alternatives (including the No Action Alternative), although the Preferred Alternative and the other action alternatives could result in an increase in the number of active ingredients being released on public lands.

There would be short-term adverse impacts but long-term benefits to vegetation, fish, and wildlife, including resources used for subsistence purposes. Potential exposures to herbicides used by the BLM would be cumulative to exposures to other pesticides, as well as other chemicals that are released to the environment as a result of human activities. Mitigation measures and SOPs would help minimize impacts to fish, wildlife, and native plants. A countervailing effect of long-term improvement in ecosystem health as a result of successful herbicide treatments would offset short-term losses.

Although aminopyralid, fluroxypyr, and rimsulfuron are of low toxicity to fish and wildlife, some of the currently approved herbicides may harm these resources through certain exposure scenarios. Treatments would also alter wildlife habitat and behavior. The extent of these disturbances would vary by individual treatments. In general, large, aerial applications of herbicides would be most likely to result in exposures to wildlife in the area.

Subsistence users would be warned of planned sprayings ahead of time, and may need to avoid certain areas during and after vegetation treatments. There may also be a perception by subsistence users that subsistence resources are being tainted by exposure to herbicides and other chemicals, particularly in more pristine areas.

Treatments that improve habitat would provide long-term benefits to fish and wildlife. Treatments that remove hazardous fuels from public lands and reduce the risk of large, intense wildfire would reduce future death and injury of wildlife and lead to improved habitat. Treatments that control populations of non-native species on public lands would be expected to benefit most fish and wildlife over the long term by aiding in the re-establishment of native vegetation and restoring habitats to near historical conditions.

Regardless of the alternative chosen, there would be a cumulative loss of native vegetation and healthy ecosystem function. Over the long term, treatments should slow this loss and help to restore native vegetation and natural fire regimes and benefit ecosystem health and wildlife and their habitats.

In addition to the programmatic-level analysis provided in the PEIS, site-specific analysis would be conducted on proposed projects, to include an analysis of potential effects on subsistence resources, if applicable.

Evaluation of the Availability of Other Lands for the Purpose Sought to be Achieved

The purpose sought to be achieved under the PEIS and is to use aminopyralid, fluroxypyr, and rimsulfuron in the BLM's herbicide treatment programs, to increase the options available for preventing the spread and establishment of invasive plants and reducing hazards caused by excessive fuel loads. The lands that would be selected for weed control or fuels reduction treatments include areas on public lands where invasive plants occur and areas with an abundance of fire fuels that increase the likelihood of catastrophic fire. The objectives of treatments are to restore land health. In the future, proposed treatment areas would

be prioritized and analyzed under an appropriate NEPA document. Given that future treatments would occur on public lands only, other lands would not be available for this purpose. Lands administered by other federal agencies in Alaska are directed by their own planning documents. State- and Native Corporation-administered lands cannot be considered in a BLM plan, and under BLM policy other public lands outside of Alaska are not considered under ANILCA.

Evaluation of Other Alternatives that would Reduce or Eliminate the Use, Occupancy, or Disposition of Public Lands Needed for Subsistence Purposes

In addition to the Preferred Alternative to allow use of aminopyralid, fluroxypyr, and rimsulfuron in vegetation treatment programs, other alternatives would include the No Action Alternative to use only the currently approved herbicides, and the other action alternatives that are presented and analyzed in Chapters 2 and 4, which place certain restriction on use of the new active ingredients. These alternatives were created to represent a range of options for feasibly attaining or approximating the BLM's objectives for herbicide use on public lands, as expressed in its programs, policies, and land use plans.

Finding

Actions described in the PEIS, when taken into consideration with the analysis presented as the cumulative case, would not significantly restrict subsistence use and needs in Alaska. While herbicide treatments are likely to occur in Alaska in the future, the estimated treatment area is 1,000 acres or less, statewide, per year. Additionally, the new herbicides being proposed for use are of lower toxicity to fish and wildlife that might be used for subsistence than many of the currently approved herbicides. When proposed, site-specific projects will continue to require additional NEPA analysis, which will include public input and consultation with local native communities and entities that could be affected. A subsequent ANILCA § 810 Analysis of Subsistence Impacts will also be required for each proposed project.

Environmental Justice

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, and an accompanying Presidential memorandum require each federal agency to make the consideration of Environmental Justice part of its mission. The existing demographics (race and income) and subsistence consumption of plants and animals, and mitigating measures and their effects are presented.

Consultation and Coordination with Indian Tribal Governments

Executive Order 13175, *Consultation and Coordination with Indian Tribal Governments*, requires consultation with tribal governments on "actions that have substantial direct effects on one or more Indian tribes." Representatives of the BLM have solicited input from local tribal governments and Alaska Native Corporations to discuss subsistence issues relating to use of aminopyralid, fluroxypyr, and rimsulfuron (see Chapter 5, Consultation and Coordination). The BLM has also met with local tribal governments to discuss use of herbicides in the larger vegetation treatment program, and has established a dialogue on Environmental Justice with these communities.

In addition to ANILCA, Environmental Justice, as defined in Executive Order 12898, also calls for an analysis of the effects of federal actions on minority populations with regard to subsistence. Specifically, Environmental Justice is:

> The fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment means that no group of people, including racial, ethnic, or socioeconomic group should bear a disproportionate share of the adverse environmental consequences resulting from industrial, municipal, and commercial operations or the execution of federal, state, local, and tribal programs and policies.

Section 4-4 of Executive Order 12898, regarding the Subsistence Consumption of Fish and Wildlife, requires federal agencies to collect, maintain, and analyze information on the consumption patterns of populations that principally rely on fish and/or wildlife for subsistence, and to communicate to the public any risks associated with the consumption patterns. To this end, the subsistence analyses of all alternatives, located in Chapter 4 (Environmental Consequences) of the PEIS, have been reviewed and found to comply with Environmental Justice.

Further guidance is found in the CEQ document, *Environmental Justice – Guidance under the National Environmental Policy Act*, December 1997, and USEPA, Region 2, Interim Environmental Justice Policy December 2000. Additionally, the USDOI has an *Environmental Justice Strategic Plan 2012 – 2017* (USDOI 2012).

Government-to-Government Consultation with Federally-Recognized Tribes

The BLM formally consults with federally recognized tribes before taking actions that will have a substantial, direct effect on federally recognized tribes or their assets, rights, services, or programs. The BLM initiated consultation with Alaska Native groups in the form of a letter sent on April 18, 2013, to 519 tribes and Alaska Native Corporations throughout the 17 states that could be directly affected by vegetation management activities. The letter requested information on how the proposed activities could impact Native American and Alaska Native interests, including the use of vegetation and wildlife for subsistence, religious, and ceremonial purposes. The Alaska BLM District office in Fairbanks made the decision not to hold one or more public scoping meetings in Alaska based on low attendance at the meetings for the earlier PEIS, low past and projected future use of herbicides in Alaska, and the overlap of the public scoping period with that of an Environmental Assessment for a different project involving herbicide use (*The Dalton Management Area Integrated Invasive Plant Strategic Plan*). In lieu of a public scoping meeting, the BLM Fairbanks District office offered to host a web-based meeting for anyone who wanted to learn more about the project and provide comments. As no members of the public responded to this offer, no web-based meeting for the project was held.

When future vegetation treatment projects are proposed, local BLM offices will initiate site-specific analysis and NEPA documentation. This process will include consultation with Alaska Native groups to determine if culturally important areas and plants could be impacted by proposed vegetation treatments. Proposed treatments of plants that are important for maintaining traditional lifeways may need to be modified or cancelled in certain areas. On the other hand, there may be long-term benefits, such as reducing or eliminating invasive plant competitors, which would allow proliferation of traditionally used plants.

References

Council on Environmental Quality. 1997. Considering Cumulative Effects Under the National Environmental Policy Act. Washington, D.C.

Hebert, M. 2001. Strategic Plan for Noxious and Invasive Plants Management in Alaska. University of Alaska. Fairbanks, Alaska.

U.S. Department of Interior (USDOI). 2012. Environmental Justice Strategic Plan 2012 – 2017. Office of Environmental Quality and Compliance. Washington, D.C.

U.S. Department of Interior Bureau of Land Management (USDOI BLM). 2007a. Final Vegetation Treatments on Bureau of Land Management Lands in 17 Western States Programmatic Environmental Impact Statement. Washington, D.C. Available at: http://www.blm.gov/wo/st/en/prog/more/veg_eis.html.

_____. 2007b. Record of Decision for Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in 17 Western States Programmatic Environmental Impact Statement. Washington, D.C. Available at: http://www.blm.gov/wo/st/en/prog/more/veg_eis.html.

_____. 2009. Draft Dalton Management Area Integrated Invasive Plant Strategic Plan. Central Yukon Field Office. Fairbanks, Alaska.

_____. 2013. Dalton Management Area Integrated Invasive Plant Strategic Plan Environmental Assessment. Central Yukon Field Office. Fairbanks, Alaska.

APPENDIX D

DESCRIPTION OF VEGETATION MACROGROUPS

APPENDIX D

DESCRIPTION OF VEGETATION MACROGROUPS

Introduction

Table D-1 provides a a list of all the vegetation macrogroups occurring on BLM-administered lands in the western U.S., as well as their associated classes, subclasses, formations, and divisions. This section provides descriptions of the subset of macrogroups that comprise the majority of the BLM's proposed vegetation treatments, as referenced in Table 4-9 of this PEIS.

The macrogroup is a middle-level classification in the hierarchy of the revised United States National Vegetation Classification[1]. The middle-level classifications are based on plant physiognomy, biogeography, and floristics. The macrogroup level classification is based on "combinations of moderate sets of diagnostic plant species and diagnostic growth forms that reflect biogeographic differences."

The ecological context of the macrogroup level is sub-continental to regional differences in mesoclimate, geology, substrates, hydrology, and disturbance regimes. An example of a scientific name for a macrogroup is the *Pseudotsuga menziesii-Quercus garryana-Pinus ponderosa-Arbutus menziesii* (Douglas-fir-Oregon white oak-ponderosa pine-Pacific madrone) macrogroup. The colloquial name for this macrogroup is Northern Vancouverian Montane and Foothill Forest.

In order to match the geographical breakdown in the 2007 PEIS, the macrogroup descriptions in this section are presented by ecoregion. Descriptions for macrogroups found in more than one ecoregion are repeated, where applicable. Descriptions come directly from the U.S. National Vegetation Classification web site.

Marine Ecoregion

Californian-Vancouverian Foothill and Valley Forest and Woodland

These forests occur along the Pacific Coast lowlands from southern California to southern British Columbia. They occur inland from the coast, in the dry interior lowland valleys, some on the east side of the Cascades, and are drought-tolerant. These forests are not part of the Temperate Coastal Rainforest. Dominant species within this macrogroup are *Pseudotsuga menziesii*, *Pinus ponderosa*, *Quercus garryana*, *Quercus kelloggii* (California black oak), *Lithocarpus densiflorus* (tanoak), *Umbellularia californica* (California laurel), and *Arbutus menziesii*.

Vancouverian Lowland and Montane Rainforest

This macrogroup consists of tall forests 164 to 328 feet (50 to 100 meters) dominated by evergreen needle-leaved trees of the Pacific Northwest coast, limited to the coast, in lowland valleys, and lower mountain slopes (below subalpine snow pack) of the Coastal and Cascade Ranges. Forests include those influenced by salt spray exposure, the interior forests of the windward and leeward Coast and Cascade Ranges, and cool temperate lower montane forests where winter snowpack typically lasts for 2 to 6 months, sometimes referred to as the "rain-on-snow" zone because of the common occurrence of major winter rainfall on an established snowpack. Climate is wet, mild maritime.

[1] Available at: http://usnvc.org/

TABLE D-1
Vegetation Classification System for Western States

Formation Class	Formation Subclass	Formation	Division	Macrogroup
Forest and Woodland	Temperate Forest	Warm Temperate Forest	Southwestern North American Warm Temperate Forest	California Forest and Woodland
				Californian-Vancouverian Foothill and Valley Forest and Woodland
				Comanchian Forest and Woodland
				Madrean Warm Lowland Evergreen Woodland
				Madrean Warm Montane Forest and Woodland
			Southwestern North American Warm Temperate Scrub and Woodland	Southern Plains Scrub Woodland and Shrubland
		Cool Temperate Forest	Western North American Cool Temperate Forest	Southern Vancouverian Montane and Foothill Forest
				Vancouverian Lowland and Montane Rainforest
				Northern Rocky Mountain Lower Montane and Foothill Forest
				Rocky Mountain Subalpine and High Montane Conifer Forest
				Sierra Madre High Montane Forest
				Southern Rocky Mountain Lower Montane Forest
				Vancouverian Subalpine Forest
			Western North American Cool Temperate Woodland and Scrub	Intermountain Singleleaf Pinyon-Western Juniper Woodland
				Rocky Mountain Two-Needle Pinyon-Juniper Woodland

TABLE D-1 (Cont.)
Vegetation Classification System for Western States

Formation Class	Formation Subclass	Formation	Division	Macrogroup
Forest and Woodland (cont.)	Temperate Forest (Cont.)	Temperate Flooded and Swamp Forest	Western North American Flooded and Swamp Forest	Rocky Mountain and Great Basin Flooded and Swamp Forest
				Vancouverian Flooded and Swamp Forest
			Southwestern North American Warm Temperate Flooded and Swamp Forest	Warm Mediterranean and Desert Riparian, Flooded and Swamp Forest
				Western North American Warm Temperate Ruderal Flooded and Swamp Forest
	Boreal Forest	Lowland and Montane Boreal Forest	North American Boreal Forest	North American Subalpine and Subarctic Woodland
				Western North American Boreal Conifer and Hardwood Forest
		Boreal Flooded and Swamp Forest	North American Boreal Flooded and Swamp Forest	North American Boreal Flooded Forest
				North American Boreal Swamp Forest
				Western Boreal Flooded and Swamp Scrub and Forest
Shrubland and Grassland	Mediterranean Scrub and Grassland	Mediterranean Scrub	California Scrub	California Chaparral
				California Coastal Scrub
		Mediterranean Grassland and Forb Meadow	California Grassland and Meadow	California Annual and Perennial Grassland
				California Ruderal Grassland and Meadow

TABLE D-1 (Cont.)
Vegetation Classification System for Western States

Formation Class	Formation Subclass	Formation	Division	Macrogroup
Shrubland and Grassland (Cont.)	Temperate and Boreal Shrubland and Grassland	Temperate Grassland, Meadow and Shrubland	Western North American Grassland and Shrubland	Northern Rocky Mountain-Vancouverian Montane and Foothill Grassland and Shrubland
				Northern Vancouverian Lowland and Montane Grassland and Shrubland
				Rocky Mountain-Vancouverian Subalpine and High Montane Mesic Grass and Forb Meadow
				Southern Rocky Mountain Montane Grassland and Shrubland
				Southern Vancouverian Lowland Grassland and Shrubland
			Great Plains Grassland and Shrubland	Great Plains Mixedgrass Prairie and Shrubland
				Great Plains Shortgrass Prairie and Shrubland
			Western North American Interior Sclerophyllous Chaparral Shrubland	Cool Interior Chaparral
				Warm Interior Chaparral
		Boreal Grassland, Meadow and Shrubland	North American Boreal Grassland, Meadow and Shrubland	North American Boreal Shrubland and Grassland
		Temperate and Boreal Scrub and Herb Coastal Vegetation	Pacific North American Coast Scrub and Herb Vegetation	Cool Pacific Coastal Beach, Dune and Bluff Vegetation
				Warm Pacific Coastal Beach, Dune and Bluff Vegetation
		Temperate and Boreal Bog and Fen	North American Bog and Fen	North American Boreal Bog and Fen
				North Pacific Bog and Fen
				Rocky Mountain Subalpine and Montane Fen

TABLE D-1 (Cont.)
Vegetation Classification System for Western States

Formation Class	Formation Subclass	Formation	Division	Macrogroup
Shrubland and Grassland (Cont.)	Temperate and Boreal Shrubland and Grassland (Cont.)	Temperate and Boreal Freshwater Wet Meadow and Marsh	Western North American Freshwater Wet Meadow and Marsh	Western North American Boreal Wet Meadow and Marsh
				Western North American Lowland Freshwater Wet Meadow, Marsh and Shrubland
				Western North American Montane Wet Meadow and Low Shrubland
				Western North American Ruderal Wet Meadow and Marsh
				Western North American Vernal Pool
			Southwestern North American Warm Desert Freshwater Marsh	Warm Desert Freshwater Shrubland, Meadow and Marsh
		Salt Marsh	Temperate and Boreal Pacific Coastal Salt Marsh	North American Pacific Coastal Salt Marsh
			North American Western Interior Brackish Marsh	Cool Semi-Desert Alkaline-Saline Wetland
				Warm Semi-Desert and Mediterranean Alkaline-Saline Wetland
Semi-Desert	Warm Semi-Desert Scrub and Grassland	Warm Semi-Desert Scrub and Grassland	North American Warm Desert Scrub and Grassland	Apacherian-Chihuahuan Semi-Desert Grassland and Steppe
				Chihuahuan Desert Scrub
				Mojave-Sonoran Semi-Desert Scrub
				North American Warm Desert Alkaline-Saline Semi-Desert Scrub
				North American Warm Desert Xero-Riparian

TABLE D-1 (Cont.)
Vegetation Classification System for Western States

Formation Class	Formation Subclass	Formation	Division	Macrogroup
Semi-Desert (Cont.)	Cool Semi-Desert Scrub and Grassland	Cool Semi-Desert Scrub and Grassland	Western North American Cool Semi-Desert Scrub and Grassland	Great Basin and Intermountain Dry Shrubland and Grassland
				Great Basin and Intermountain Dwarf Sage Shrubland and Steppe
				Great Basin and Intermountain Tall Sagebrush Shrubland and Steppe
				Great Basin and Intermountain Xero-Riparian Scrub
				Great Basin Saltbrush Scrub
Polar and High Montane Vegetation	Temperate and Boreal Alpine Vegetation	Alpine Scrub, Forb Meadow and Grassland	Western North American Alpine Scrub, Forb Meadow and Grassland	Rocky Mountain Alpine Scrub, Forb Meadow and Grassland
				Sierra Madre Alpine Scrub, Forb Meadow and Grassland
				Vancouverian Alpine Scrub, Forb Meadow and Grassland
	Tundra	Dwarf-Shrub, Herb and Nonvascular Tundra	Arctic Tundra	North American Arctic Tundra
		Tundra Wet Meadow	Arctic Tundra Wet Meadow	Arctic Tundra Wet Meadow
Aquatic Vegetation	Freshwater Aquatic Vegetation	Freshwater Aquatic Vegetation	North American Freshwater Aquatic Vegetation	Western North American Freshwater Aquatic Vegetation

Source: Developed by the BLM based on the Federal Geographic Data Committee Vegetation Subcommittee's National Vegetation Classification Standard, Version 2 (Federal Geographic Data Committee 2008).

Forests along the immediate coast experience uniformly wet and mild climate, where precipitation averages 79 to 118 inches (2,000 to 3,000 millimeters) per year, with frequent fog and low clouds during warmer months, and additional precipitation from fog drip can be significant. Away from the coast, climate is still mild but with more moisture and temperature extremes. Major forest tree species are *Pseudotsuga menziesii*, *Tsuga heterophylla* (western hemlock), *Thuja plicata* (western redcedar), *Abies amabilis* (Pacific silver fir), *Chamaecyparis nootkatensis* (Alaska cedar), and *Picea sitchensis* (Sitka spruce). The deciduous broad-leaved trees *Alnus rubra* (red alder) and *Acer macrophyllum* (bigleaf maple) are abundant on recently disturbed sites. *Pinus contorta* (lodgepole pine) is common along the ocean. *Abies grandis* (grand fir) and *Pinus monticola* (western white pine) occur sporadically and *Sequoia sempervirens* (redwood), *Umbellularia californica*, and *Chamaecyparis lawsoniana* (Port Orford cedar) are found in southern Oregon and northern California.

Southern Vancouverian Lowland Grassland and Shrubland

This macrogroup is found from Vancouver Island down the Pacific Coast to San Francisco. It occurs along the coast on coastal terraces and ridgeline balds in the Coast Ranges, the Klamath Mountains, and at low elevations on the lee side of the coastal mountains in the northern part of the range. Steep slopes on coastal bluffs and headlands are typical occurrences of this macrogroup, though sometimes it can be found on relatively level ridgelines. Attributable to shallow soils, steep slopes, sunny aspect, and/or upper slope position, these sites are dry and marginal for tree establishment and growth except in favorable microsites. The vegetation is grassland with some dwarf-shrubs, which can occur as small patches but are usually in a matrix with the herbaceous vegetation. Bunchgrasses are often dominant and may include *Calamagrostis nutkaensis* (Pacific reedgrass), *Festuca rubra* (red fescue), *Festuca roemeri* (Roemer's fescue), or *Danthonia californica* (California oatgrass). Dwarf-shrub species imbedded in the herbaceous cover often include *Arctostaphylos uva-ursi* (kinnikinnick), *Arctostaphylos Columbiana* (hairy manzanita), *Arctostaphylos nevadensis* (pinemat manzanita), *Gaultheria shallon* (salal), *Juniperus communis* (common juniper), *Rubus spectabilis* (salmonberry), and *Vaccinium ovatum* (California huckleberry). Occasionally, scattered stunted trees, such as *Picea sitchensis*, *Pseudotsuga menziesii* or *Quercus garryana*, can be present.

Mediterranean Ecoregion

California Forest and Woodland

This macrogroup consists of savannas, woodlands, and forests dominated by Californian endemic oak and conifer species. These woodlands occur almost entirely within California below 8,000 ft (2,450 m) (8,000 ft). They include the oak woodlands of *Quercus agrifolia* (California live oak), *Quercus lobata* (valley oak), and *Quercus douglasii* (blue oak). Stands include rare endemic evergreen coniferous forests limited to the coast including *Hesperocyparis macrocarpa* (Monterey cypress), *Cupressus sargentii* (Sargent's cypress), *Pinus muricata* (Bishop pine), and *Pinus torreyana* (Torrey pine), as well as the more widespread, rugged *Pinus sabiniana* (California foothill pine) and *Pinus coulteri* (Coulter pine).

Californian-Vancouverian Foothill and Valley Forest and Woodland

These forests occur along the Pacific Coast lowlands from southern California to southern British Columbia. They occur inland from the coast, in the dry interior lowland valleys, some on the east side of the Cascades, and are drought-tolerant. These forests are not part of the Temperate Coastal Rainforest. Dominant species within this macrogroup are *Pseudotsuga menziesii*, *Pinus ponderosa*, *Quercus garryana*, *Quercus kelloggii*, *Lithocarpus densiflorus*, *Umbellularia californica*, and *Arbutus menziesii*.

Southern Vancouverian Montane and Foothill Forest

This macrogroup includes forests and woodlands of foothill and lower montane elevations of the southern Cascade and Klamath Mountains, the Modoc Plateau, and the Sierra Nevada, Peninsula, and Transverse Ranges. This macrogroup covers a broad range of elevation and latitude, and for the most part occurs in relatively dry habitats. It includes dry montane *Pinus jeffreyi* (Jeffrey pine)-*Pinus ponderosa* woodlands; Sierran mixed conifer woodlands dominated by *Pseudotsuga menziesii*, *Pinus ponderosa*, *Calocedrus decurrens* (Incense cedar), *Abies concolor* (white fir), *Abies magnifica* (California red fir), *Pinus lambertiana*

(sugar pine), *Pinus jeffreyi*, or *Sequoiadendron giganteum* (giant sequoia); mixed conifer woodlands tolerant of serpentine soils; and the forests on the east side of the Sierra Nevada, on the Modoc Plateau and in the Warner Mountains that are dominated by *Pinus monticola* and/or *Abies concolor* var. *lowiana* (Sierra white fir) where *Pinus ponderosa* is often present, but *Pseudotsuga menziesii* is notably absent.

California Chaparral

This macrogroup is composed of evergreen sclerophyllous shrubland that dominates the cismontane side of the coastal mountain ranges from about San Francisco south to Ensanada in Baja California, and east into the foothills of the Sierra Nevada. It reaches its greatest extent in the Transverse and Peninsular ranges of central and southern California but is also an important part of the western foothills of the Sierra Nevada. Chaparral occurs from sea level to 4,921 feet (1,500 meters). Chaparral is closely associated with the Mediterranean climate pattern of winter rain and summer drought. Within that climate regime it can be found under a wide range of rainfall and temperature conditions, but over 60 percent of the current distribution is in areas that receive between 10 and 30 inches (250 and 750 millimeters) of annual precipitation, and where average January daily temperature falls between 41 and 59 °F (5 and 15 °C), indicating that summer drought stress may limit chaparral shrub seedling establishment and that injury to adult shrubs from winter freezes may impose species-specific distributional limits. Chaparral soils tend to be shallow and rocky. Substrates include fractured sandstones and shales, coarse-grained decomposed granitic soils, fine-grained weathered volcanics, and mafic substrates such as serpentines and gabbros. These substrates add to the landscape diversity and have substantial effects on plant species diversity. The diversity of shrubs in chaparral includes shrub species such as *Adenostoma fasciculatum* (chamise), *Ceanothus cuneatus* (buckbrush), *Ceanothus megacarpus* (bigpod ceanothus), *Ceanothus crassifolius* (hoaryleaf ceanothis), several species of *Arctostaphylos* (manzanita), and *Cercocarpus montanus* (alderleaf mountain mahogany).

Cool Interior Chaparral

This macrogroup consists of chaparral that occurs on sideslopes between low-elevation desert landscapes and higher pinyon-juniper woodlands of the western and central Great Basin on steep, exposed slopes with rocky and/or shallow soils, and among montane forests above 4,550 feet (1,500 meters), from the southern Cascades of Oregon to the Peninsular Ranges of California into Baja California, Mexico, where much annual precipitation occurs as snow. These hardy shrublands have open canopies with little undergrowth and are dominated by evergreen or winter-deciduous shrubs. Dominant shrubs include *Arctostaphylos glandulosa* (Eastwood's manzanita), *Arctostaphylos nevadensis*, *Arctostaphylos patula* (greenleaf manzanita), *Arctostaphylos pungens* (pointleaf manzanita), *Ceanothus cordulatus* (whitethorn ceanothus), *Ceanothus diversifolius* (pinemat), *Ceanothus greggii* (desert ceanothus), *Ceanothus integerrimus* (deerbrush), *Ceanothus pinetorum* (Coville ceanothus), *Ceanothus sanguineus* (redstem ceanothus; in Oregon), *Ceanothus velutinus* (snowbrush ceanothus), *Cercocarpus intricatus* (litteleaf mountain mahogany), *Cercocarpus montanus* var. *glaber* (birchleaf mountain mahogany), *Chrysolepis sempervirens* (=*Castanopsis empervirens*; bush chinquapin), *Eriogonum fasciculatum* (Eastern Mojave buckwheat), *Garrya flavescens* (ashy siltassel), *Holodiscus discolor* (=*Holodiscus microphyllus*; oceanspray), *Prunus emarginata* (bitter cherry), *Prunus subcordata* (Klamath plum), *Prunus virginiana* (chokecherry), *Purshia stansburiana* (Stansbury cliffrose), *Quercus garryana* var. *breweri* (Brewer's oak), *Quercus turbinella* (Sonoran scrub oak), and *Rhus trilobata* (skunkbush sumac). Most of these chaparral species are fire-adapted, resprouting vigorously after burning or producing fire-resistant seeds.

California Annual and Perennial Grassland

This macrogroup is found in Mediterranean California from 30 to 3.600 feet (10 to 1,200 meters), with cool, wet winters and hot, dry summers, receiving on average 20 inches (50 centimeters; range 10 to 30 inches [25 to 100 centimeters]) of precipitation per year, mainly as winter rain. It is found with fine-textured soils, moist or even waterlogged in winter, but very dry in summer. Historically, these grasslands were common among oak savanna and woodland and probably experienced similar frequent fire regimes. Today they are limited to small relictual, remnant and restored stands. These communities are best represented on xeric to mesic ultramafic (a type of igneous rock) sites where alien annual grasses are less

well-adapted. Wet ultramafic sites may contain stands of *Muhlenbergia rigens* (deergrass) or *Leymus triticoides* (beardless wildrye). Characteristic plant species include a dominance by native, cool-season bunchgrasses *Nassella pulchra* (purple needlegrass), *Nassella cernua* (nodding needlegrass), *Nassella lepida* (foothill needlegrass), *Aristida* species (threeawn), *Agoseris heterophylla* (annual agoseris), *Elymus glaucus* (blue wildrye), *Leymus triticoides* (beardless wildrye), *Festuca californica (*California fescue*), Melica californica* (California melicgrass), and *Poa secunda* (=*Poa scabrella*; Sandberg bluegrass), and native forbs such as *Achyrachaena mollis* (blow wives), *Bloomeria crocea* (common goldenstar), *Triteleia ixioides* (=*Brodiaea lutea*; prettyface), *Chlorogalum pomeridianum* (wavyleaf soap plant), *Clarkia purpurea* (winecup clarkia), *Dodecatheon jeffreyi* (Sierra shootingstar), *Achillea millefolium* var. *borealis* (=*Achillea borealis*; boreal yarrow), and *Castilleja attenuata* (=*Orthocarpus attenuatis*; attenuate Indian paintbrush).

California Ruderal Grassland and Meadow

This macrogroup encompasses the non-native-dominated annual grasslands found in California. They occur on the coastal plains, in the Central Valley, in the foothills and in disturbed rural and urban areas. California annual grassland is found on a wide variety of soils, sometimes in complex mosaics. Most are noncalcic Mollisols, medium to heavy texture, about 1.6 feet (0.5 meters) deep. Native graminoid and forb species can be present with low or insignificant cover. The overwhelming dominance of introduced species is undeniable. Non-native species make up 50 to 96 percent of the foliar cover. Dominant introduced graminoid species include *Avena fatua* (wild oat), *Bromus diandrus* (ripgut brome), *Bromus hordeaceus* (soft brome), *Bromus madritensis* (compact brome), *Lolium perenne* ssp. *multiflorum* (=*Lolium multiflorum*; Italian ryegrass), *Taeniatherum caput-medusae* (medusahead rye), and *Aegilops triuncialis* (barbed goatgrass). Introduced forb species include *Erodium botrys* (longbeak stork's bill), *Erodium cicutarium* (redstem stork's bill), *Medicago polymorpha* (burclover), *Geranium dissectum* (cutleaf geranium), *Hypochaeris glabra* (smooth cat's ear), and *Carduus pycnocephalus* (Italian plumeless thistle). There are many more species that can be dominant.

Subtropical Desert Ecoregion

Madrean Warm Montane Forest and Woodland

This woodland and forest group occurs in mountains and plateaus in the Sierra Madre Occidentale and Sierra Madre Orientale in Mexico, Trans-Pecos Texas, southern New Mexico and Arizona, generally south of the Mogollon Rim. These forests and woodlands are composed of Madrean pines (*Pinus arizonica* [Arizona pine], *Pinus engelmannii* [Apache pine], *Pinus leiophylla* [Chihuahuan pine], *Pinus strobiformis* [Southwestern white pine]) or madrones (*Arbutus arizonica* [Arizona madrone], *Arbutus xalapensis* [Texas madrone]) and evergreen oaks (*Quercus arizonica* [Arizona white oak], *Quercus emoryi* [Emory oak], *Quercus gravesii* [Chisos red oak], *Quercus grisea* [gray oak], *Quercus hypoleucoides* [silverleaf oak], or *Quercus rugosa* [netleaf oak]) intermingled with patchy shrublands on most mid-elevation slopes 4,790 to 7,546 feet (1,460 to 2,300 meters). In northern stands, *Pinus ponderosa* dominates with Madrean oak species. This group also includes *Hesperocyperis arizonica* (Arizona cypress)-dominated stands with *Quercus hypoleucoides* or *Quercus rugosa* in the understory. Other tree species may include *Juniperus deppeana* (alligator juniper), *Juniperus flaccida* (drooping juniper), *Pinus cembroides* (Mexican pinyon), *Pinus discolor* (border pinyon), and *Pseudotsuga menziesii*. Subcanopy and shrub layers may include typical encinal (found in oak groves) and chaparral species, such as *Agave* spp. (agave), *Arctostaphylos pringlei* (Pringle manzanita), *Arctostaphylos pungens* (pointleaf manzanita), *Garrya wrightii* (Wright's silktassel), *Nolina* spp. (beargrass), and *Quercus turbinella*. Some stands have moderate cover of perennial graminoids, such as *Muhlenbergia emersleyi* (bullgrass), *Muhlenbergia longiligula* (longtongue muhly), *Muhlenbergia virescens* (screwleaf muhly), and *Schizachyrium cirratum* (Texas bluestem).

Warm Interior Chaparral

This macrogroup occurs prominently across central Arizona (Mogollon Rim) and western New Mexico, south into mountains in the northwestern Chihuahuan region and Madrean Occidentale in northern Mexico, and north into extreme southwestern Utah and southern Nevada. It also occurs in mountains in the Sonoran and western Mojave Deserts, and extends from northeast

Kern County, California, and south into Baja Norte, Mexico. Stands are found on foothills, xeric mountain slopes and canyons in hotter and drier habitats and often dominate along the mid-elevation transition zone between desert scrub and montane woodlands 3,281 to 7,218 feet (1,000 to 2,200 meters). Sites are often steep and rocky. Parent materials are varied and include basalt, diabases, gneiss, schist, shales, slates, sandstones, and more commonly, limestone and coarse-textured granitic substrates. The vegetation is characterized by a moderate to dense evergreen shrub layer dominated by sclerophyllous shrubs such as *Quercus turbinella* and *Ceanothus greggii*. Other common shrubs from the eastern portion of its range (Arizona and New Mexico) include *Quercus toumeyi* (Toumey oak), *Cercocarpus montanus* var. *paucidentatus* (hairy mountain mahogany), *Garrya wrightii*, *Purshia stansburiana*, *Rhus trilobata* (Tucker oak), with *Arctostaphylos pungens* and *Arctostaphylos pringlei* at higher elevations. In desert chaparral stands in the western part of the range, *Quercus john-tuckeri* (Tucker oak), *Quercus cornelius-mulleri* (Muller oak), *Quercus berberidifolia* (scrub oak), *Arctostaphylos patula*, *Arctostaphylos glauca* (bigberry manzanita), *Rhus ovate* (sugar sumac), *Cercocarpus montanus* var. *glaber*, *Garrya flavescens*, *Juniperus californica* (California juniper), and *Nolina parryi* (Parry's beargrass) characterize this shrubland.

Chihuahuan Desert Scrub

This macrogroup typically occurs as invasive upland shrublands that are concentrated in the extensive desert grassland in foothills and piedmonts of the Chihuahuan Desert, extending into the Sky Island region to the west. Substrates are typically derived from alluvium, often gravelly without a well-developed argillic or calcic soil horizon that would limit infiltration and storage of winter precipitation in deeper soil layers. *Prosopis* spp. (mesquite) and other deep-rooted shrubs exploit this deep-soil moisture that is unavailable to grasses and cacti. Vegetation is typically dominated by *Prosopis glandulosa* (honey mesquite) or *Prosopis velutina* (velvet mesquite) and succulents. Other desert scrub species that can codominate include *Acacia neovernicosa* (viscid acacia), *Acacia constricta* (whitethorn acacia), *Juniperus monosperma* (oneseed juniper), or *Juniperus coahuilensis* (redberry juniper). *Larrea tridentata* (creosote bush) is typically absent or has low cover. Grass cover is typically low and composed of desert grasses such as *Dasyochloa pulchella* (=*Erioneuron pulchellum*; low woollygrass), *Muhlenbergia porteri* (bush muhly), *Muhlenbergia setifolia* (curlyleaf muhly), and *Pleuraphis mutica* (tobosagrass).

Southern Plains Scrub Woodland and Shrubland

This macrogroup ranges from the High Plains, Rolling Plains, and Red Bed Plains of Texas and Oklahoma, south into parts of the Edwards Plateau and Chihuahuan Desert regions of Texas. The open to closed canopy is dominated or codominated by *Prosopis glandulosa* var. *glandulosa* (honey mesquite). Associated species can include *Ziziphus obtusifolia* (lotebush), *Quercus fusiformis* (Texas live oak), *Sideroxylon lanuginosum* (gum bully), *Aloysia gratissima* (whitebrush), *Mahonia trifoliolata* (algerita), *Yucca glauca* (soapweed yucca), *Opuntia* spp. (pricklypear), *Acacia greggii* (catclaw acacia), *Mimosa* spp. (mimosa), *Rhus lanceolata* (prairie sumac), *Nassella leucotricha* (Texas wintergrass), *Bouteloua curtipendula* (sideoats grama), *Bouteloua gracilis* (blue grama), *Bouteloua hirsute* (hairy grama), *Buchloe dactyloides* (buffalograss), *Schizachyrium scoparium* (little bluestem), *Ruellia nudiflora* (Runyon's wild petunia), *Croton monanthogynus* (prairie tea), *Rhynchosia senna* (Texas snoutbean), and *Indigofera miniata* (coastal indigo).

Subtropical Steppe Ecoregion

Rocky Mountain Two-Needle Pinyon-Juniper Woodland

These woodlands are composed of *Pinus edulis* (twoneedle pinyon), *Juniperus osteosperma* (Utah juniper), or *Juniperus monosperma*. *Pinus edulis* and/or *Juniperus osteosperma*-dominated woodlands occur on dry mountains and foothills of the Colorado Plateau region. *Juniperus monosperma*-dominated woodlands have an understory of perennial grasses such as *Bouteloua gracilis* and *Pleuraphis jamesii* (James' galleta) and other herbaceous species typical of the shortgrass prairie. These woodlands occur along the east and south foothill slopes of the southern Rocky Mountains and into the plains of southeastern Colorado and northern and central New Mexico. *Pinus edulis* and/or *Juniperus monosperma*-dominated woodlands exist on dry mountains and foothills in southern Colorado east of the Continental Divide, and in mountains and plateaus of northern and central New Mexico.

Great Plains Shortgrass Prairie and Shrubland

The shortgrass prairie in this macrogroup is dominated by the shortgrasses *Bouteloua gracilis* and *Buchloe dactyloides*. Shrublands in this macrogroup are dominated by *Prosopis glandulosa*. The shortgrass prairies occur on flat to rolling uplands. The surface soil may be sandy loam, loam, silt loam, or loamy clay. The subsoil is often finer than the surface soil. The shortgrass prairies are characterized by a moderate to dense sod of short grasses with scattered mid grasses and forbs. The foliage of these species is 3 to 7 inches (7 to 19 centimeters) tall, while the flowering stalks of *Bouteloua gracilis* may reach 18 inches (45 centimeters). The mid grasses are usually stunted by the arid conditions and often do not exceed 2.3 feet (0.7 meters). Other short graminoids found in this community are *Bouteloua hirsute* (hairy grama), *Carex duriuscula* (needleleaf sedge), *Carex inops* ssp. *heliophila* (sun sedge), and *Carex filifolia* (threadleaf sedge; in Nebraska). Several mid grasses occur regularly, such as *Aristida purpurea* (purple threeawn), *Bouteloua curtipendula*, *Pascopyrum smithii* (western wheatgrass), *Schizachyrium scoparium*, *Elymus elymoides* (squirreltail), *Sporobolus cryptandrus* (spike dropseed), *Hesperostipa comata (=Stipa comata*; needle and thread*)*, and *Vulpia octoflora* (sixweeks fescue). Forbs, such as *Astragalus* spp. (milkweed), *Gaura coccinea* (scarlet beeblossom), *Machaeranthera pinnatifida* var. *pinnatifida* (lacy tansyaster), *Opuntia polyacantha* (plains pricklypear), *Plantago patagonica* (woolly plantain), *Psoralidium tenuiflorum* (slimflower scurfpea), *Ratibida columnifera* (upright prairie coneflower), and *Sphaeralcea coccinea* (scarlet globemallow), are common throughout the shortgrass prairies.

Apacherian-Chihuahuan Semi-Desert Grassland and Steppe

This macrogroup occurs in the northern Chihuahuan Desert and adjacent Sky Islands and Sonoran Desert, extending into limited areas of the southern Great Plains on alluvial flats, loamy plains, and basins sometimes extending up into lower piedmont slopes and broad mesas. Included in this macrogroup are the mesic grasslands that occur in relatively small depressions or swales and along drainages that receive runoff from adjacent areas. Occupying low topographic positions, these sites generally have deep, fine-textured soils that are neutral to slightly or moderately saline/alkaline. Vegetation is characterized by a moderately dense to dense graminoid layer of perennial grasses that is typically dominated by *Pleuraphis mutica* or with *Bouteloua eriopoda* (black grama) codominant (more historically) or *Bouteloua gracilis* on broad alluvial plains and flats. In mesic swales and depressions and along drainages, *Sporobolus airoides* (alkali sacaton), *Sporobolus wrightii* (big sacaton), and *Pleuraphis mutica* (tobosa swales) dominate, sometimes with other mesic graminoids such as *Pascopyrum smithii* or *Panicum obtusum* (vine mesquite). *Sporobolus airoides* is more common in alkaline soils and along drainages. In degraded stands, *Scleropogon brevifolius* (burrograss), *Dasyochloa pulchella*, or *Aristida* spp. may co-dominate. *Pleuraphis jamesii* can become important in northern stands and *Bouteloua gracilis* in the Great Plains and on degraded stands. Scattered shrub or succulent species can be present, especially on degraded sites and along drainages and in depressions.

Warm Interior Chaparral

This macrogroup occurs prominently across central Arizona (Mogollon Rim) and western New Mexico, south into mountains in the northwestern Chihuahuan region and Madrean Occidentale in northern Mexico, and north into extreme southwestern Utah and southern Nevada. It also occurs in mountains in the Sonoran and western Mojave Deserts, and extends from northeast Kern County, California, and south into Baja Norte, Mexico. Stands are found on foothills, xeric mountain slopes and canyons in hotter and drier habitats and often dominate along the mid-elevation transition zone between desert scrub and montane woodlands 3,281 to 7,218 feet (1,000 to 2,200 meters). Sites are often steep and rocky. Parent materials are varied and include basalt, diabases, gneiss, schist, shales, slates, sandstones, and more commonly, limestone and coarse-textured granitic substrates. The vegetation is characterized by a moderate to dense evergreen shrub layer dominated by sclerophyllous shrubs such as *Quercus turbinella* and *Ceanothus greggii*. Other common shrubs from the eastern portion of its range (Arizona and New Mexico) include *Quercus toumeyi*, *Cercocarpus montanus* var. *paucidentatus*, *Garrya wrightii*, *Purshia stansburiana*, *Rhus trilobata*, with *Arctostaphylos pungens* and *Arctostaphylos pringlei* at higher elevations. In desert chaparral stands in the western part of the range, *Quercus john-tuckeri*, *Quercus cornelius-mulleri*, *Quercus berberidifolia*, *Arctostaphylos patula*, *Arctostaphylos glauca*, *Rhus ovata*, *Cercocarpus montanus* var. *glaber*

(=*Cercocarpus betuloides*), *Garrya flavescens*, *Juniperus californica*, and *Nolina parryi* characterize this shrubland.

Chihuahuan Desert Scrub

This macrogroup typically occurs as invasive upland shrublands that are concentrated in the extensive desert grassland in foothills and piedmonts of the Chihuahuan Desert, extending into the Sky Island region to the west. Substrates are typically derived from alluvium, often gravelly without a well-developed argillic or calcic soil horizon that would limit infiltration and storage of winter precipitation in deeper soil layers. *Prosopis* spp. and other deep-rooted shrubs exploit this deep-soil moisture that is unavailable to grasses and cacti. Vegetation is typically dominated by *Prosopis glandulosa* or *Prosopis velutina* and succulents. Other desert scrub species that can codominate include *Acacia neovernicosa*, *Acacia constricta*, *Juniperus monosperma*, or *Juniperus coahuilensis*. *Larrea tridentata* is typically absent or has low cover. Grass cover is typically low and composed of desert grasses such as *Dasyochloa pulchella* (=*Erioneuron pulchellum*), *Muhlenbergia porteri*, *Muhlenbergia setifolia*, and *Pleuraphis mutica*.

Southern Plains Scrub Woodland and Shrubland

This macrogroup ranges from the High Plains, Rolling Plains, and Red Bed Plains of Texas and Oklahoma, south into parts of the Edwards Plateau and Chihuahuan Desert regions of Texas. The open to closed canopy is dominated or codominated by *Prosopis glandulosa* var. *glandulosa*. Associated species can include *Ziziphus obtusifolia*, *Quercus fusiformis*, *Sideroxylon lanuginosum*, *Aloysia gratissima*, *Mahonia trifoliolata*, *Yucca glauca*, *Opuntia* spp., *Acacia greggii*, *Mimosa* spp., *Rhus lanceolata*, *Nassella leucotricha*, *Bouteloua curtipendula*, *Bouteloua gracilis*, *Bouteloua hirsuta*, *Buchloe dactyloides*, *Schizachyrium scoparium*, *Ruellia nudiflora*, *Croton monanthogynus*, *Rhynchosia senna*, and *Indigofera miniata*.

Temperate Desert Ecoregion

Northern Rocky Mountain Lower Montane and Foothill Forest

This macrogroup consists of *Pinus ponderosa* woodlands and "wooded steppes", located in the foothills of the northern Rocky Mountains in the Columbia Plateau region and west along the foothills of the Modoc Plateau and Eastern Cascades into southern interior British Columbia. It also occurs east across Idaho into the eastern foothills of the Montana Rockies. These woodlands and wooded steppes occur at the lower treeline/ecotone between grasslands or shrublands and more mesic coniferous forests, typically on warm, dry, exposed sites. These woodlands and wooded steppes receive winter and spring rains, and thus have a greater spring "green-up" compared with the drier woodlands in the central Rockies. However, sites are often too droughty to support a closed tree canopy. Elevations range from less than 1,640 feet (500 meters) in British Columbia to 5,249 feet (1,600 meters) in the central Idaho mountains. Occurrences are found on all slopes and aspects; however, moderately steep to very steep slopes or ridgetops and plateaus are most common. These woodlands and wooded steppes generally occur on most geological substrates, from weathered rock to glacial deposits to eolian deposits. Characteristic soil features include good aeration and drainage, coarse textures, circumneutral to slightly acidic pH, an abundance of mineral material, and periods of drought during the growing season.

The *Pinus ponderosa* woodlands have a shrubby or grassy understory, whereas the *Pinus ponderosa* wooded steppes have widely spaced, scattered *Pinus ponderosa* trees over generally shrubby but sparse understories. The woodlands are generally fire-maintained, whereas the wooded steppes are often too dry and with vegetation too widely spaced to be able to carry fire. *Pinus ponderosa* var. *ponderosa* is the predominant conifer; *Pseudotsuga menziesii* or *Pinus flexilis* (limber pine) can be present in the tree canopy but are usually absent. The understory can be shrubby, with *Artemisia tridentata* (big sagebrush), *Arctostaphylos patula*, *Arctostaphylos uva-ursi*, *Cercocarpus ledifolius* (curl-leaf mountain mahogany), *Physocarpus malvaceus* (mallow ninebark), *Purshia tridentata* (antelope bitterbrush), *Symphoricarpos oreophilus* (mountain snowberry) or *Symphoricarpos albus* (common snowberry), *Amelanchier alnifolia*

(Saskatoon serviceberry), and *Rosa* spp. (rose) being common species. In transition areas with sagebrush steppe, *Purshia tridentata*, *Artemisia tridentata* ssp. *wyomingensis* (Wyoming big sagebrush), *Artemisia tridentata* ssp. *tridentata* (basin big sagebrush), and *Artemisia tripartita* (threetip sagebrush) can be common in fire-protected sites such as rocky areas. Deciduous shrubs, such as *Physocarpus malvaceus*, *Symphoricarpos albus*, or *Spiraea betulifolia* (white spirea), can be abundant in more northerly sites or more moist climates. Herbaceous vegetation in the wooded steppes is predominantly fire-resistant grasses and forbs that resprout after surface fires; shrubs, understory trees and downed logs are uncommon. The wooded steppes support grasses such as *Pseudoroegneria spicata* (bluebunch wheatgrass), *Hesperostipa* spp. (needle and thread), *Achnatherum* spp. (needlegrass), dry *Carex* (sedge) species (*Carex inops* [long-stolon sedge]), *Elymus elymoides*, *Festuca idahoensis* (Idaho fescue), or *Festuca campestris* (rough fescue).

Southern Rocky Mountain Lower Montane Forest

These forests are dominated by *Pinus ponderosa*, either solely or mixed with *Pseudotsuga menziesii*, *Pinus edulis*, *Pinus contorta*, *Populus tremuloides* (quaking aspen), and *Juniperus* spp. (juniper). Ponderosa pine forests with a mixture of other tree species have a typically shrubby understory composed of *Artemisia nova* (black sagebrush), *Artemisia tridentata*, *Arctostaphylos patula*, *Arctostaphylos uva-ursi*, *Cercocarpus montanus*, *Purshia stansburiana*, *Purshia tridentata*, *Quercus gambelii* (Gambel oak), *Symphoricarpos* spp., *Prunus virginiana*, *Amelanchier alnifolia*, and *Rosa* spp. Common grasses in the understory include *Pseudoroegneria spicata*, *Pascopyrum smithii*, and species of *Hesperostipa*, *Achnatherum*, *Festuca*, *Muhlenbergia*, and *Bouteloua*. Ponderosa pine forests dominated solely by ponderosa pine have a grass-dominated understory composed of *Festuca arizonica* (Arizona fescue), *Muhlenbergia virescens*, *Pseudoroegneria spicata*, *Andropogon gerardii* (big bluestem), *Schizachyrium scoparium*, *Festuca idahoensis*, *Piptatherum micranthum* (littleseed ricegrass), and *Bouteloua gracilis*.

Intermountain Singleleaf Pinyon-Western Juniper Woodland

These woodlands are composed of *Pinus monophylla* (singleleaf pinyon), *Juniperus osteosperma*, or *Juniperus occidentals* (western juniper). Woodlands composed of scattered *Juniperus osteosperma* trees exist on dry foothills and sandsheets of the Colorado Plateau and eastern Great Basin. *Juniperus osteosperma* woodlands have an understory dominated by grasses such as *Bouteloua gracilis*, *Hesperostipa comata*, and *Pleuraphis jamesii*. Woodlands dominated by *Pinus monophylla* form an open to dense tree layer, often with the wider ranging *Juniperus osteosperma*. These woodlands exist on dry mountain ranges of the Great Basin region and eastern foothills of the Sierra Nevada. Woodlands dominated by *Juniperus occidentalis* are largely restricted to the Columbia Plateau region and *Pinus monophylla* is not present.

Rocky Mountain Two-Needle Pinyon-Juniper Woodland

These woodlands are composed of *Pinus edulis*, *Juniperus osteosperma*, or *Juniperus monosperma*. *Pinus edulis* and/or *Juniperus osteosperma*-dominated woodlands occur on dry mountains and foothills of the Colorado Plateau region. *Juniperus monosperma*-dominated woodlands have an understory of perennial grasses such as *Bouteloua gracilis* and *Pleuraphis jamesii* and other herbaceous species typical of the shortgrass prairie. These woodlands occur along the east and south foothill slopes of the southern Rocky Mountains and into the plains of southeastern Colorado and northern and central New Mexico. *Pinus edulis* and/or *Juniperus monosperma*-dominated woodlands exist on dry mountains and foothills in southern Colorado east of the Continental Divide, and in mountains and plateaus of northern and central New Mexico.

Northern Rocky Mountain-Vancouverian Montane and Foothill Grassland and Shrubland

This macrogroup is composed of shrublands in the lower montane and foothill regions around the Columbia Basin and north and east into the Northern Rockies, and dry grasslands occurring in the canyons and valleys of the northern Great Basin and Columbia Basin, particularly along the Snake River canyon, the

lower foothill slopes of the Blue Mountains, and along the main stem of the Columbia River in eastern Washington.

The shrublands typically occur below treeline, within the matrix of surrounding low-elevation grasslands and sagebrush shrublands, usually on steep slopes of canyons on all aspects. *Rhus glabra* (smooth sumac), *Amelanchier alnifolia*, *Prunus emarginata*, *Prunus virginiana*, *Rosa* spp., *Symphoricarpos oreophilus*, and *Holodiscus discolor* are the most common dominant shrubs, occurring alone or in any combination. Occurrences in central and eastern Wyoming can include *Artemisia tridentata* ssp. *vaseyana* (mountain big sagebrush) and *Cercocarpus montanus*, but neither of these are dominant, and where they occur the stands are truly mixes of shrubs, often with *Amelanchier alnifolia*, *Prunus virginiana*, and others being the predominant taxa. *Festuca idahoensis*, *Festuca campestris*, *Calamagrostis rubescens* (pinegrass), *Carex geyeri* (Geyer's sedge), *Aristida purpurea*, *Koeleria macrantha* (prairie junegrass), *Pseudoroegneria spicata*, and *Poa secunda* are the most important grasses. *Geum triflorum* (old man's whiskers), *Potentilla gracilis* (slender cinquefoil), *Lomatium triternatum* (nineleaf biscuitroot), *Balsamorhiza sagittata* (arrowleaf balsamroot), and species of *Eriogonum* (buckwheat), *Phlox* (phlox), and *Erigeron* (fleabane) are important forbs.

The grasslands are found on steep open slopes, from 300 to 5,000 feet (90 to 1,525 meters). Soils are derived from residuum and have patchy, thin, wind-blown surface deposits. Slope failures are common occurrences. The grasslands are dominated by patchy graminoid cover, cacti, and some forbs. *Aristida purpurea* var. *longiseta* (Fendler threeawn), *Sporobolus cryptandrus*, *Poa secunda*, *Pseudoroegneria spicata*, *Festuca idahoensis*, and *Opuntia polyacantha* are common species. Deciduous shrubs *Rhus glabra*, *Symphoricarpos* spp., *Physocarpus malvaceus*, *Holodiscus discolor*, and *Ribes* spp. (gooseberry) are infrequent native species that can increase with fire exclusion.

Southern Rocky Mountain Montane Grassland and Shrubland

This macrogroup is composed of shrublands dominated by *Amelanchier utahensis* (Utah serviceberry), *Cercocarpus montanus*, or *Quercus gambelii*. Stands dominated by one or another of these shrubs often intergrade with each other. This macrogroup is found in the mountains, plateaus, foothills, and canyon slopes of the southern Rocky Mountains and Colorado Plateau, and on outcrops and canyon slopes in the western Great Plains. It ranges from the southern and central Great Plains, southwest to southern New Mexico, extending north into Wyoming, and west into the Intermountain West region. These shrublands occur between 4,921 and 9,514 feet (1,500 and 2,900 meters) and are usually associated with exposed sites, rocky substrates, and dry conditions, which limit tree growth. Where *Cercocarcus montanus* dominates pure stands in parts of Wyoming and Colorado, *Quercus gambelii* is absent. *Quercus gambelii* is typically dominant on the more mesic and higher elevation sites from 6,562 to 9,514 feet (2,000 to 2,900 meters). On stands where *Quercus gambelii* is dominant, other vegetation typically includes *Amelanchier alnifolia*, *Amelanchier utahensis*, *Artemisia tridentata*, *Cercocarpus montanus*, *Prunus virginiana*, *Purshia stansburiana*, *Purshia tridentata*, *Robinia neomexicana* (New Mexico locust), *Symphoricarpos oreophilus*, or *Symphoricarpos rotundifolius* (mountain snowberry). On stands where *Cercocarpus montanus* is dominant, other vegetation typically includes *Amelanchier utahensis*, *Purshia tridentata*, *Rhus trilobata*, *Ribes cereum* (wax currant), *Symphoricarpos oreophilus*, or *Yucca glauca*. Grasses are represented by species of *Muhlenbergia* (muhly), *Bouteloua*, *Hesperostipa*, and *Pseudoroegneria spicata*.

Great Basin and Intermountain Dry Shrubland and Grassland

This macrogroup consists of shrubland-steppe and grasslands. The shrubland-steppe occurs throughout the Colorado Plateau, Arizona-New Mexico Mountains, west to the Mojave Desert, and north to the Wyoming Basin, on alluvial flats and fans, talus slopes, plateaus, and bluffs. Slopes range from gentle to steep, and substrates are variable and include sandstone talus, fine-textured alluvium, sand, clay, loams, cinder, cobbles, and coarse gravels. These shrubland-steppes can either be shrub-dominated, dwarf shrub-dominated, or grass dominated with a sparse shrub layer. Common shrubs include *Atriplex canescens* (fourwing saltbush), *Eriogonum corymbosum* (crispleaf buckwheat), *Ericameria nauseosa* (rubber rabbitbrush), *Ephedra viridis* (Mormon tea), *Ephedra torreyana* (Torrey's jointfir), *Krascheninnikovia lanata* (winterfat), *Chrysothamnus viscidiflorus* (yellow rabbitbrush), *Tetradymia canescens* (spineless horsebrush), and *Gutierrezia sarothrae* (broom snakeweed). Herbaceous species include *Pleuraphis jamesii*, *Bromus tectorum*

(cheatgrass), *Achnatherum hymenoides* (Indian ricegrass), *Aristida purpurea*, and *Hesperostipa comata*.

The grasslands are semi-arid to arid and are located throughout the intermountain western U.S. They occur on sites over an elevational range of about 3,609 to 10,794 feet (1,100 to 3,290 meters) in most of the range, and 1,148 to 1,394 feet (350 to 425 meters) in the Columbia Basin on a variety of landforms, including swales, playas, mesas, alluvial flats, and plains. These grasslands constitute a matrix over large areas of intermountain basins, and also can occur as large patches in mosaics with semi-desert shrublands. Substrates are often well-drained sandy or loam soils derived from sedimentary parent materials, but are quite variable and can include fine-textured soils derived from igneous and metamorphic rocks. The dominant perennial bunchgrasses and shrubs of these grasslands are all drought-resistant plants. Dominant or codominant species are *Achnatherum hymenoides*, *Achnatherum lettermanii* (Letterman's needlegrass), *Achnatherum nelsonii* (Columbia needlegrass), *Achnatherum speciosum* (desert needlegrass), *Bouteloua eriopoda*, *Bouteloua gracilis*, *Hesperostipa comata*, *Pleuraphis jamesii*, *Poa cusickii* (Cusick's bluegrass), *Poa secunda*, and *Pseudoroegneria spicata*. Scattered shrubs and dwarf-shrubs often are present, especially *Artemisia tridentata* ssp. *tridentata*, *Artemisia tridentata* ssp. *wyomingensis*, *Atriplex* spp. (saltbush), *Coleogyne* spp. (coleogyne), *Ephedra* spp. (jointfir), *Gutierrezia sarothrae*, and *Krascheninnikovia lanata*, which are the typical dominant species of adjacent shrublands.

Great Basin and Intermountain Tall Sagebrush Shrubland and Steppe

This macrogroup consists of shrublands and shrub-steppe that is widely distributed from the Great Basin, Columbia River Basin, Colorado Plateau, northern Rocky Mountains, and northwestern Great Plains, as far east as the Dakotas, at elevations as low as 1,640 feet (500 meters) in the northwestern Great Plains to 8,202 feet (2,500 meters) in the Rocky Mountains and Colorado Plateau. This macrogroup occurs on flat to steeply sloping upland slopes on alluvial fans and terraces, toeslopes, lower and middle slopes, draws, badlands, and foothills. Sites with little slope tend to have deep soils, whereas those with steeper slopes have shallow to moderately deep soils. Climate ranges from arid in the western Great Basin to subhumid in the northern Great Plains and Rocky Mountains, with much of the precipitation falling primarily as snow. The amount and reliability of growing-season moisture increase eastward and with increasing elevation. Stands are dominated by *Artemisia tridentata* ssp. *wyomingensis* and *Artemisia tridentata* ssp. *tridentata* and, in some cases, codominated by *Amelanchier utahensis*, *Atriplex canescens*, *Ephedra nevadensis* (Nevada jointfir), *Ephedra viridis*, *Ericameria nauseosa*, or *Sarcobatus vermiculatus* (greasewood). Other common shrubs include *Artemisia frigida* (prairie sagewort), *Atriplex confertifolia* (shadscale saltbush), *Atriplex gardneri* (Gardner's saltbush), *Chrysothamnus* spp. (rabbitbrush), *Ericameria* spp. (rabbitbrush), *Grayia spinosa* (spiny hopsage), *Krascheninnikovia lanata*, *Peraphyllum ramosissimum* (wild crab apple), *Prunus virginiana*, *Purshia tridentata*, *Symphoricarpos longiflorus* (desert snowberry), and *Tetradymia* spp. (horsebrush). The herbaceous layer can be sparse to strongly dominated by graminoids including *Achnatherum hymenoides*, *Achnatherum lettermanii*, *Achnatherum pinetorum* (pine needlegrass), *Achnatherum thurberianum* (Thurber's needlegrass), *Bouteloua gracilis*, *Bromus tectorum*, *Carex filifolia*, *Elymus albicans* (Montana wheatgrass), *Elymus elymoides*, *Elymus lanceolatus* (thickspike wheatgrass), *Festuca idahoensis*, *Hesperostipa comata*, *Leymus ambiguous* (Colorado wildrye), *Pleuraphis jamesii*, *Poa fendleriana* (muttongrass), *Poa secunda*, *Pseudoroegneria spicata*, *Sporobolus airoides*, and *Sporobolus cryptandrus*.

Temperate Steppe Ecoregion

Northern Rocky Mountain Lower Montane and Foothill Forest

This macrogroup consists of *Pinus ponderosa* woodlands and "wooded steppes," located in the foothills of the northern Rocky Mountains in the Columbia Plateau region and west along the foothills of the Modoc Plateau and Eastern Cascades into southern interior British Columbia, and east across Idaho into the eastern foothills of the Montana Rockies. These woodlands and wooded steppes occur at the lower treeline/ecotone between grasslands or shrublands and more mesic coniferous forests, typically on warm, dry, exposed sites. These woodlands and wooded steppes receive winter and spring rains, and thus have a greater spring "green-up" compared with the drier woodlands in the central Rockies. However, sites are often too droughty to

support a closed tree canopy. Elevations range from less than 1,640 feet (500 meters) in British Columbia to 5,249 feet (1,600 meters) in the central Idaho mountains. Occurrences are found on all slopes and aspects; however, moderately steep to very steep slopes or ridgetops and plateaus are most common. These woodlands and wooded steppes generally occur on most geological substrates, from weathered rock to glacial deposits to eolian deposits. Characteristic soil features include good aeration and drainage, coarse textures, circumneutral to slightly acidic pH, an abundance of mineral material, and periods of drought during the growing season.

The *Pinus ponderosa* woodlands have a shrubby or grassy understory, whereas the *Pinus ponderosa* wooded steppes have widely spaced, scattered *Pinus ponderosa* trees over generally shrubby but sparse understories. The woodlands are generally fire-maintained, whereas the wooded steppes are often too dry and with vegetation too widely spaced to be able to carry fire. *Pinus ponderosa* var. *ponderosa* is the predominant conifer; *Pseudotsuga menziesii* or *Pinus flexilis* can be present in the tree canopy but are usually absent. The understory can be shrubby, with *Artemisia tridentata*, *Arctostaphylos patula*, *Arctostaphylos uva-ursi*, *Cercocarpus ledifolius*, *Physocarpus malvaceus*, *Purshia tridentata*, *Symphoricarpos oreophilus* or *Symphoricarpos albus*, *Amelanchier alnifolia*, and *Rosa* spp. being common species. In transition areas with sagebrush steppe, *Purshia tridentata*, *Artemisia tridentata* ssp. *wyomingensis*, *Artemisia tridentata* ssp. *tridentata*, and *Artemisia tripartita* can be common in fire-protected sites such as rocky areas. Deciduous shrubs, such as *Physocarpus malvaceus*, *Symphoricarpos albus*, or *Spiraea betulifolia*, can be abundant in more northerly sites or more moist climates. Herbaceous vegetation in the wooded steppes is predominantly fire-resistant grasses and forbs that resprout after surface fires; shrubs, understory trees and downed logs are uncommon. The wooded steppes support grasses such as *Pseudoroegneria spicata*, *Hesperostipa* spp., *Achnatherum* spp., dry *Carex* species (*Carex inops*), *Elymus elymoides*, *Festuca idahoensis*, or *Festuca campestris*.

Also included are *Pinus ponderosa* woodlands that occur along the eastern face of the Rocky Mountains and into the Great Plains. These woodlands are variable, ranging from very sparse patches of trees on drier sites, to nearly closed-canopy forest stands on north slopes or in draws where available soil moisture is greater. They occur primarily on gentle to steep slopes along escarpments, buttes, canyons, rock outcrops or ravines and can grade into surrounding mixed grass prairie. Soils typically range from well-drained loamy sands to sandy loams formed in colluvium, weathered sandstone, limestone, scoria, or eolian sand. These woodlands are primarily dominated by *Pinus ponderosa* but can include a sparse to relatively dense understory of *Juniperus scopulorum* (Rocky Mountain juniper), *Thuja occidentalis* (arborvitae), or *Cercocarpus* species (mountain mahogany) with just a few scattered trees. Deciduous trees are an important component in some areas (western Dakotas, Black Hills) and are sometimes codominant with *Pinus ponderosa*, including *Fraxinus pennsylvanica* (green ash), *Betula papyrifera* (paper birch), *Quercus macrocarpa* (bur oak), *Ulmus Americana* (American elm), *Acer negundo* (boxelder), and *Populus tremuloides*. Important or common shrub species with *Pinus ponderosa* can include *Arctostaphylos uva-ursi*, *Mahonia repens* (creeping barberry), *Yucca glauca*, *Symphoricarpos* spp., *Prunus virginiana*, *Juniperus communis*, *Juniperus horizontalis* (creeping juniper), *Amelanchier alnifolia*, *Rhus trilobata*, and *Physocarpus monogynus* (mountain ninebark). The herbaceous understory can range from sparse to a dense layer with species typifying the surrounding mixed grass prairie, with mixed grass species common such as *Andropogon gerardii*, *Bouteloua curtipendula*, *Carex inops* ssp. *heliophila*, *Carex filifolia*, *Danthonia intermedia* (timber oatgrass), *Koeleria macrantha*, *Nassella viridula* (green needlegrass), *Oryzopsis asperifolia* (roughleaf ricegrass), *Pascopyrum smithii*, *Piptatherum micranthum*, and *Schizachyrium scoparium*.

Southern Rocky Mountain Lower Montane Forest

These forests are dominated by *Pinus ponderosa*, either solely or mixed with *Pseudotsuga menziesii*, *Pinus edulis*, *Pinus contorta*, *Populus tremuloides*, and *Juniperus* spp. Ponderosa pine forests with a mixture of other tree species have a typically shrubby understory composed of *Artemisia nova*, *Artemisia tridentata*, *Arctostaphylos patula*, *Arctostaphylos uva-ursi*, *Cercocarpus montanus*, *Purshia stansburiana*, *Purshia tridentata*, *Quercus gambelii*, *Symphoricarpos* spp., *Prunus virginiana*, *Amelanchier alnifolia*, and *Rosa* spp. Common grasses in the understory include *Pseudoroegneria spicata*, *Pascopyrum smithii*, and species of *Hesperostipa*, *Achnatherum*, *Festuca*, *Muhlenbergia*, and *Bouteloua*. Ponderosa pine forests dominated solely by ponderosa pine have a grass-

dominated understory composed of *Festuca arizonica*, *Muhlenbergia virescens*, *Pseudoroegneria spicata*, *Andropogon gerardii*, *Schizachyrium scoparium*, *Festuca idahoensis*, *Piptatherum micranthum*, and *Bouteloua gracilis*.

Intermountain Singleleaf Pinyon-Western Juniper Woodland

These woodlands are composed of *Pinus monophylla*, *Juniperus osteosperma*, or *Juniperus occidentalis*. Woodlands composed of scattered *Juniperus osteosperma* trees exist on dry foothills and sandsheets of the Colorado Plateau and eastern Great Basin. *Juniperus osteosperma* woodlands have an understory dominated by grasses such as *Bouteloua gracilis*, *Hesperostipa comata*, and *Pleuraphis jamesii*. Woodlands dominated by *Pinus monophylla* form an open to dense tree layer, often with the wider ranging *Juniperus osteosperma*. These woodlands exist on dry mountain ranges of the Great Basin region and eastern foothills of the Sierra Nevada. Woodlands dominated by *Juniperus occidentalis* are largely restricted to the Columbia Plateau region and *Pinus monophylla* is not present.

Rocky Mountain Two-Needle Pinyon-Juniper Woodland

These woodlands are composed of *Pinus edulis*, *Juniperus osteosperma*, or *Juniperus monosperma*. *Pinus edulis* and/or *Juniperus osteosperma*-dominated woodlands occur on dry mountains and foothills of the Colorado Plateau region. *Juniperus monosperma*-dominated woodlands have an understory of perennial grasses such as *Bouteloua gracilis* and *Pleuraphis jamesii* and other herbaceous species typical of the shortgrass prairie. These woodlands occur along the east and south foothill slopes of the southern Rocky Mountains and into the plains of southeastern Colorado and northern and central New Mexico. *Pinus edulis* and/or *Juniperus monosperma*-dominated woodlands exist on dry mountains and foothills in southern Colorado east of the Continental Divide, and in mountains and plateaus of northern and central New Mexico.

Northern Rocky Mountain-Vancouverian Montane and Foothill Grassland and Shrubland

This macrogroup is composed of shrublands in the lower montane and foothill regions around the Columbia Basin and north and east into the Northern Rockies, and various types of grasslands. The grasslands are geographically extensive in this ecoregion, with one type of grassland being a dry grassland occurring in the canyons and valleys of the northern Great Basin and Columbia Basin particularly along the Snake River canyon, the lower foothill slopes of the Blue Mountains, and along the main stem of the Columbia River in eastern Washington, another grassland type commonly referred to as the Palouse Prairie in the Blue Mountains of Oregon and north into the Okanagan and Fraser Plateaus of British Columbia and the Canadian Rockies, and another grassland type located in the mountains and large valleys of northwestern Wyoming and western Montana, and east into the central Montana mountain "islands" foothills and the Rocky Mountain Front and Big and Little Belt Ranges.

The shrublands typically occur below treeline, within the matrix of surrounding low-elevation grasslands and sagebrush shrublands, usually on steep slopes of canyons on all aspects. *Rhus glabra*, *Amelanchier alnifolia*, *Prunus emarginata*, *Prunus virginiana*, *Rosa* spp., *Symphoricarpos oreophilus*, and *Holodiscus discolor* are the most common dominant shrubs, occurring alone or in any combination. Occurrences in central and eastern Wyoming can include *Artemisia tridentata* ssp. *vaseyana* and *Cercocarpus montanus*, but neither of these are dominant, and where they occur the stands are truly mixes of shrubs, often with *Amelanchier alnifolia*, *Prunus virginiana*, and others being the predominant taxa. *Festuca idahoensis*, *Festuca campestris*, *Calamagrostis rubescens*, *Carex geyeri*, *Aristida purpurea*, *Koeleria macrantha*, *Pseudoroegneria spicata*, and *Poa secunda* are the most important grasses. *Geum triflorum*, *Potentilla gracilis*, *Lomatium triternatum*, *Balsamorhiza sagittata*, and species of *Eriogonum*, *Phlox*, and *Erigeron* are important forbs.

The dry grasslands are found on steep open slopes, from 300 to 5,000 feet (90 to 1,525 meters). Soils are derived from residuum and have patchy, thin, wind-blown surface deposits. Slope failures are common occurrences. The grasslands are dominated by patchy

graminoid cover, cacti, and some forbs. *Aristida purpurea* var. *longiseta*, *Sporobolus cryptandrus*, *Poa secunda*, *Pseudoroegneria spicata*, *Festuca idahoensis*, and *Opuntia polyacantha* are common species. Deciduous shrubs *Rhus glabra*, *Symphoricarpos* spp., *Physocarpus malvaceus*, *Holodiscus discolor*, and *Ribes* spp. are infrequent native species that can increase with fire exclusion. The Palouse Prairie grasslands are found on rolling topography composed of loess hills and plains lying over basalt plains. The climate of these grasslands has warm to hot, dry summers and cool, wet winters. Annual precipitation is high, ranging between 15 and 30 inches (38 and 76 centimeters). Soils are typically deep, well-developed, and old. The remaining grasslands outside of the Palouse Prairie area are influenced by shorter summers, colder winters, and young soils derived from recent glacial and alluvial material. In the eastern portion of the range in Montana, winter precipitation is replaced by a large spring peak in precipitation. Elevations range from 984 to 5,413 feet (300 to 1,650 meters), ranging from small meadows to large open parks surrounded by conifers in the lower montane, to extensive foothill and valley grasslands below the lower treeline. Many of these valleys may have been primarily sage-steppe with patches of grassland in the past, but because of land-use history post-settlement (herbicide, grazing, fire suppression, pasturing) they have been converted to grassland-dominated areas. Soils are relatively deep, fine-textured, often with coarse fragments, and non-saline, often with a biological soil crust. The most important species are cool-season perennial bunch grasses and forbs (greater than 25 percent cover), sometimes with a sparse (less than 10 percent cover) shrub layer. *Festuca campestris* and *Festuca idahoensis* are dominants, and *Pseudoroegneria spicata* occurs as a codominant, as well as a diversity of other native grasses. Forb diversity is typically high in both mesic and dry aspects of these grasslands.

Southern Rocky Mountain Montane Grassland and Shrubland

This macrogroup is composed of shrublands dominated by *Amelanchier utahensis*, *Cercocarpus montanus*, or *Quercus gambelii*. Stands dominated by one or another of these shrubs often intergrade with each other. This macrogroup is found in the mountains, plateaus, foothills, and canyon slopes of the southern Rocky Mountains and Colorado Plateau, and on outcrops and canyon slopes in the western Great Plains. It ranges from the southern and central Great Plains, southwest to southern New Mexico, extending north into Wyoming, and west into the Intermountain West region. These shrublands occur between 4,921 and 9,514 feet (1,500 and 2,900 meters) and are usually associated with exposed sites, rocky substrates, and dry conditions, which limit tree growth. Where *Cercocarcus montanus* dominates pure stands in parts of Wyoming and Colorado, *Quercus gambelii* is absent. *Quercus gambelii* is typically dominant on the more mesic and higher elevation sites from 6,562 to 9,514 feet (2,000 to 2,900 meters). On stands where *Quercus gambelii* is dominant, other vegetation typically includes *Amelanchier alnifolia*, *Amelanchier utahensis*, *Artemisia tridentata*, *Cercocarpus montanus*, *Prunus virginiana*, *Purshia stansburiana*, *Purshia tridentata*, *Robinia neomexicana*, *Symphoricarpos oreophilus*, or *Symphoricarpos rotundifolius*. On stands where *Cercocarpus montanus* is dominant, other vegetation typically includes *Amelanchier utahensis*, *Purshia tridentata*, *Rhus trilobata*, *Ribes cereum*, *Symphoricarpos oreophilus*, or *Yucca glauca*. Grasses are represented by species of *Muhlenbergia*, *Bouteloua*, *Hesperostipa*, and *Pseudoroegneria spicata*.

Great Plains Shortgrass Prairie and Shrubland

The shortgrass prairie in this macrogroup is dominated by the shortgrasses *Bouteloua gracilis* and *Buchloe dactyloides*. Shrublands in this macrogroup are dominated by *Prosopis glandulosa*. The shortgrass prairies occur on flat to rolling uplands. The surface soil may be sandy loam, loam, silt loam, or loamy clay. The subsoil is often finer than the surface soil. The shortgrass prairies are characterized by a moderate to dense sod of short grasses with scattered mid grasses and forbs. The foliage of these species is 3 to 7 inches (7 to 19 centimeters) tall, while the flowering stalks of *Bouteloua gracilis* may reach 18 inches (45 centimeters). The mid grasses are usually stunted by the arid conditions and often do not exceed 2.3 feet (0.7 meters). Other short graminoids found in this community are *Bouteloua hirsuta*, *Carex duriuscula*, *Carex inops* ssp. *heliophila*, and *Carex filifolia* (in Nebraska). Several mid grasses occur regularly, such as *Aristida purpurea*, *Bouteloua curtipendula*, *Pascopyrum smithii*, *Schizachyrium scoparium*, *Elymus elymoides*, *Sporobolus cryptandrus*, *Hesperostipa comata*, and *Vulpia octoflora*. Forbs, such as *Astragalus* spp., *Gaura coccinea*, *Machaeranthera pinnatifida* var. *pinnatifida*, *Opuntia polyacantha*, *Plantago patagonica*, *Psoralidium tenuiflorum*,

Ratibida columnifera, and *Sphaeralcea coccinea*, are common throughout the shortgrass prairies.

Great Plains Mixedgrass Prairie and Shrubland

This macrogroup consists of mesic and dry mixed grass prairies, which extend from Kansas and New Mexico north through western Nebraska and eastern Colorado, northward through Wyoming and the western Dakotas into eastern and central Montana, west to the Rocky Mountain Front Range in Montana and Wyoming. The mesic mixed grass prairies are a mixture of mostly mixed grass prairie with some tallgrass prairie, on mostly moderate to gentle slopes, usually at the base of foothill slopes (for example the hogbacks of the Rocky Mountain Front Range, where it typically occurs as a relatively narrow elevational band between montane woodlands and shrublands and the shortgrass steppe). It also occurs east on the Front Range piedmont alongside the Chalk Bluffs near the Colorado-Wyoming border, out into the Great Plains on the Palmer Divide in Colorado, and on piedmont slopes below mesas and foothills in northeastern New Mexico. Soil texture is the defining environmental descriptor; soils are primarily mesic, fine and medium textured, and do not include sands, sandy soils, or sandy loams. Graminoids typically comprise the greatest amount of canopy cover and include *Pascopyrum smithii*, *Nassella viridula*, *Andropogon gerardii*, and *Festuca idahoensis* (in Montana). Other species include *Schizachyrium scoparium*, *Muhlenbergia montana* (mountain muhly), *Sporobolus cryptandrus*, *Sorghastrum nutans* (Indiangrass), *Pseudoroegneria spicata*, *Bouteloua gracilis*, and *Bouteloua curtipendula*. Shrub species such as *Symphoricarpos* spp., *Artemisia frigida*, and *Artemisia cana* (silver sagebrush) also can occur. With intensive grazing, cool-season exotic species such as *Poa pratensis* (Kentucky bluegrass), *Bromus inermis* (smooth brome), and *Bromus japonicus* (Japanese brome) can increase in dominance. Shrub species such as *Juniperus virginiana* (eastern redcedar) can also increase in dominance with fire suppression.

The dry mixed grass prairies occur on flat to rolling topography with deep, sandy loam to loam, coarse-textured soils. The vegetation is dominated by moderate to moderately dense medium-tall grasses and scattered shrubs. Dominant species include *Hesperostipa comata*, *Carex inops* ssp. *heliophila*, and *Carex filifolia*. *Calamovilfa longifolia* (prairie sandreed) is often found with high cover values on sandier soils, and *Koeleria macrantha* cover increases on degraded sites. Other common species include *Hesperostipa neomexicana* (New Mexico feathergrass), *Hesperostipa curtiseta* (shortbristle needle and thread), and *Schizachyrium scoparium*. Common woody species include *Dasiphora fruticosa* spp. *floribunda* (shrubby cinquefoil), *Rhus trilobata*, and *Juniperus horizontalis*.

APPENDIX E

SPECIAL STATUS SPECIES LIST

APPENDIX E

SPECIAL STATUS SPECIES LIST

Common Name	Scientific Name	State[1]	Class	Status[2]
Abalone, white	*Haliotis sorenseni*	CA	Invertebrate	FE
Abronia, transmontane	*Abronia turbinata*	OR	Plant	BS
Adders-tongue	*Ophioglossum pusillum*	MT, OR	Plant	BS
Adobe-lily, striped	*Fritillaria striata*	CA	Plant	BS
Agave, Arizona	*Agave arizonica*	AZ	Plant	FE
Agave, Murphey's	*Agave murpheyi*	AZ	Plant	BS
Agave, Santa Cruz striped	*Agave parviflora*	AZ	Plant	BS
Agoseris, pink	*Agoseris lackschewitzii*	ID	Plant	BS
Agoseris, tall	*Agoseris elata*	OR	Plant	BS
Albatross, short-tailed	*Phoebastris albatrus*	AK, CA, OR	Bird	FE
Alkaligrass, Howell's	*Puccinellia howellii*	CA	Plant	BS
Alkaligrass, Lemmon's	*Puccinellia lemmonii*	MT	Plant	BS
Alkaligrass, Parish's	*Puccinellia parishii*	CA	Plant	BS
Alkaligrass, Wright's	*Puccinellia wrightii*	AK	Plant	BS
Allocarya, Calistoga	*Plagiobothrys strictus*	CA	Plant	FE
Allocarya, coral-seeded	*Plagiobothrys figuratus*	OR	Plant	BS
Allocarya, desert	*Plagiobothrys salsus*	OR	Plant	BS
Alopecurus, Sonoma	*Alopecurus aequalis*	CA	Plant	FE
Alumroot, Duran's	*Heuchera duranii*	CA	Plant	BS
Alumroot, gooseberry-leaved	*Heuchera grossulariifolia*	OR	Plant	BS
Ambersnail, Kanab	*Oxyloma haydeni kanabensis*	AZ	Invertebrate	FE
Ambrosia, San Diego	*Ambrosia pumila*	CA	Plant	FE
Ammannia	*Ammannia robusta*	OR	Plant	BS
Amole, narrow-leaved	*Chlorogalum angustifolium*	OR	Plant	BS
Amole, purple	*Chlorogalum purpureum*	CA	Plant	FT
Amphipod, Arizona cave	*Stygobromus arizonensis*	AZ	Invertebrate	BS
Amphipod, Malheur cave	*Stygobromus hubbsi*	OR	Invertebrate	BS
Amphipod, Noel's	*Gammarus desperatus*	NM	Invertebrate	FE
Anemone, bog	*Anemone oregana*	OR	Plant	BS
Angelica, King's	*Angelica kingii*	ID	Plant	BS
Angelica, rough	*Angelica scabrida*	NV	Plant	BS
Apple, Squaw	*Peraphyllum ramosissimum*	OR	Plant	BS
Arnica, northern	*Arnica lonchophylla*	AK	Plant	BS
Arnica, Shasta	*Arnica viscosa*	OR	Plant	BS
Arrowhead, Sanford's	*Sagittaria sanfordii*	CA	Plant	BS

Common Name	Scientific Name	State[1]	Class	Status[2]
Artemisia, Estes	*Artemisia ludoviciana* ssp. *estesii*	OR	Plant	BS
Aster, Gorman's	*Eucephalus gormanii*	OR	Plant	BS
Aster, Huachuca golden	*Heterotheca rutteri*	AZ	Plant	BS
Aster, Jessica's	*Aster jessicae*	ID	Plant	BS
Aster, Laguna Mountains	*Dieteria asteroides*	CA	Plant	BS
Aster, Orcutt's woody	*Xylorhiza orcuttii*	CA	Plant	BS
Aster, pygmy	*Aster pygmaeus*	AK	Plant	BS
Aster, Red Rock Canyon	*Lonactis caelestis*	NV	Plant	BS
Aster, rush	*Aster borealis*	OR	Plant	BS
Aster, San Bernardino	*Symphyotrichum defoliatum*	CA	Plant	BS
Aster, tall alpine	*Oreostemma elatum*	CA	Plant	BS
Aster, wayside	*Eucephalus vialis*	OR	Plant	BS
Aster, white-topped	*Sericocarpus rigidus*	OR	Plant	BS
Avens, slender-stemmed	*Geum rossii*	OR	Plant	BS
Avens, water	*Geum rivale*	OR	Plant	BS
Azalea, alpine	*Loiseleuria procumbens*	OR	Plant	BS
Baccharis, Encinitas	*Baccharis vanessae*	CA	Plant	FT
Balloonvine	*Cardiospermum corindum*	AZ, ID	Plant	BS
Balsamroot, big-scale	*Balsamorhiza macrolepis*	CA	Plant	BS
Balsamroot, lanate	*Balsamorhiza lanata* ssp.	CA	Plant	BS
Balsamroot, large-leafed	*Balsamorhiza macrophylla*	MT	Plant	BS
Balsamroot, silky	*Balsamorhiza sericea*	CA	Plant	BS
Balsamroot, woolly (=Hooker's)	*Balsamorhiza hookeri* ssp.	CA, OR	Plant	BS
Barberry, island	*Berberis pinnata*	CA	Plant	FE
Barberry, Kofa Mountain	*Berberis harrisoniana*	AZ, CA	Plant	BS
Barberry, Nevin's	*Berberis nevinii*	CA	Plant	FE
Bartonberry	*Rubus bartonianus*	OR	Plant	BS
Bat, Allen's big-eared	*Idionycteris phyllotis*	AZ, CO, NM, NV, UT	Mammal	BS
Bat, big brown	*Eptesicus fuscus*	NV	Mammal	BS
Bat, big free-tailed	*Nyctinomops macrotis*	CO, NV, UT,	Mammal	BS
Bat, Brazilian free-tailed	*Tadarida brasiliensis*	NV, UT	Mammal	BS
Bat, California leaf-nosed	*Macrotus californicus*	AZ, CA, NV	Mammal	BS
Bat, greater western mastiff	*Eumops perotis*	AZ, CA, NM, NV	Mammal	BS
Bat, hoary	*Lasiurus cinereus*	NV	Mammal	BS
Bat, lesser long-nosed	*Leptonycteris curosoae yerbabuenae*	AZ, NM	Mammal	FE
Bat, Mexican long-nosed	*Leptonycteris nivalis*	NM	Mammal	FE
Bat, Mexican long-tongued	*Choernycteris mexicana*	AZ, NM	Mammal	BS
Bat, occult little brown (Arizona)	*Myotis lucifugus*	AZ, NM	Mammal	BS

Common Name	Scientific Name	State[1]	Class	Status[2]
Bat, pale Townsend's big-eared	*Plecotus townsendii pallescens*	NM	Mammal	BS
Bat, pallid	*Antrozous pallidus*	CA, MT, NV, OR	Mammal	BS
Bat, pocketed free-tailed	*Nyctinomops femorosaccus*	AZ	Mammal	BS
Bat, silver-haired	*Lasionycteris noctivagans*	NV	Mammal	BS
Bat, spotted	*Euderma maculatum*	AZ, CA, CO, ID, MT, NV, OR, UT, WY	Mammal	BS
Bat, Townsend's big-eared	*Plecotus townsendii*	AZ, CA, CO, ID, MT, NV, OR, UT, WY	Mammal	BS
Bat, Underwood's mastiff	*Eumops underwoodi*	AZ	Mammal	BS
Bat, western red	*Lasiurus blossevillii*	NV, UT	Mammal	BS
Beaked-rush, California	*Rhynchospora californica*	CA, WY	Plant	BS
Beakrush, white	*Rhynchospora alba*	OR	Plant	BS
Bear, grizzly	*Ursus arctos horribilis*	ID, MT, OR, WY	Mammal	FT
Bear, polar	*Ursus maritimus*	AK	Mammal	FT
Beardtongue, Absaroka	*Penstemon absarokensis*	CA, OR, WY	Plant	BS
Beardtongue, Alamo	*Penstemon alamosensis*	NM	Plant	BS
Beardtongue, Barrett's	*Penstemon barrettiae*	OR	Plant	BS
Beardtongue, bashful	*Penstemon pudicus*	NV	Plant	BS
Beardtongue, blue-leaf	*Penstemon glaucinus*	CA, OR	Plant	BS
Beardtongue, bush	*Keckiella lemmonii*	OR	Plant	BS
Beardtongue, closed-throated	*Penstemon personatus*	CA	Plant	BS
Beardtongue, cordelia	*Penstemon floribundus*	NV	Plant	BS
Beardtongue, Death Valley	*Penstemon fruticiformis*	CA, NV	Plant	BS
Beardtongue, Degener	*Penstemon degeneri*	CO	Plant	BS
Beardtongue, Gibbens	*Penstemon gibbensii*	CO, WY	Plant	BS
Beardtongue, Graham's	*Penstemon grahamii*	CO, UT	Plant	BS
Beardtongue, Harrington	*Penstemon harringtonii*	CO	Plant	BS
Beardtongue, Jaeger	*Penstemon thompsoniae*	NV	Plant	BS
Beardtongue, Lahontan	*Penstemon palmeri*	NV	Plant	BS
Beardtongue, Mount Trumbull	*Penstemon distans*	AZ	Plant	BS
Beardtongue, Nevada dune	*Penstemon arenarius*	NV	Plant	BS
Beardtongue, Pahute Mesa	*Penstemon pahutensis*	NV	Plant	BS
Beardtongue, parachute	*Penstemon debilis*	CO	Plant	FT
Beardtongue, Penland	*Penstemon penlandii*	CO	Plant	FE
Beardtongue, Pennell	*Penstemon leiophyllus*	NV	Plant	BS
Beardtongue, pinto	*Penstemon bicolor* ssp.	AZ	Plant	BS
Beardtongue, rosy two-tone	*Penstemon bicolor* ssp.	CA, NV	Plant	BS
Beardtongue, Sheep Range	*Penstemon petiolatus*	AZ	Plant	BS
Beardtongue, stemless	*Penstemon acaulis*	WY	Plant	BS

Common Name	Scientific Name	State[1]	Class	Status[2]
Beardtongue, Stephen's	*Penstemon stephensii*	CA	Plant	BS
Beardtongue, Susanville	*Penstemon sudans*	CA, NV	Plant	BS
Beardtongue, thread-leaved	*Penstemon filiformis*	CA	Plant	BS
Beardtongue, Tiehm	*Penstemon tiehmii*	NV	Plant	BS
Beardtongue, Tracy's	*Penstemon tracyi*	CA	Plant	BS
Beardtongue, Tunnel Springs	*Penstemon concinnus*	NV	Plant	BS
Beardtongue, Wassuk	*Penstemon rubicundus*	NV	Plant	BS
Beardtongue, Whipple's	*Penstemon whippleanus*	MT	Plant	BS
Beardtongue, White River	*Penstemon scariosus* var. *albifluvis*	CO, UT	Plant	BS
Beardtongue, yellow twotone	*Penstemon bicolor*	NV	Plant	BS
Beargrass, Dehesa	*Nolina interrata*	CA	Plant	BS
Bear-poppy, dwarf	*Arctomecon humilis*	UT	Plant	FE
Bear-poppy, Las Vegas	*Arctomecon californica*	NV	Plant	BS
Bear-poppy, white	*Arctomecon merriamii*	CA, NV	Plant	BS
Beauty, Ogilvie Mountains Spring	*Claytonia ogilviensis*	AK	Plant	BS
Beavertail, short-joint	*Opuntia basilaris*	CA	Plant	BS
Bedstraw, Alvin meadow	*Galium californicum*	CA	Plant	BS
Bedstraw, boreal	*Galium kamtschaticum*	OR	Plant	BS
Bedstraw, El Dorado	*Galium californicum* ssp. *sierrae*	CA	Plant	FE
Bedstraw, Hardham's	*Galium hardhamiae*	CA	Plant	BS
Bedstraw, island	*Galium buxifolium*	CA	Plant	FE
Bedstraw, Kingston	*Galium hilendiae*	CA	Plant	BS
Bedstraw, Modoc	*Galium glabrescens*	CA	Plant	BS
Bedstraw, Onyx Peak	*Galium angustifolium*	CA	Plant	BS
Bedstraw, San Gabriel	*Galium grande*	CA	Plant	BS
Bee	*Anthophora* sp.	NV	Invertebrate	BS
Bee	*Hesperapis* sp.	NV	Invertebrate	BS
Bee	*Perdita haigi*	NV	Invertebrate	BS
Bee	*Perdita* sp.	NV	Invertebrate	BS
Bee, Mojave gypsum	*Andrena balsamorhizae*	NV	Invertebrate	BS
Bee, Mojave poppy	*Perdita meconis*	NV	Invertebrate	BS
Beehive cactus, Santa Cruz	*Coryphantha recurvata*	AZ	Plant	BS
Beeplant, yellow	*Cleome lutea*	MT	Plant	BS
Beetle, American burying	*Nicrophorus americanus*	MT, WY	Invertebrate	FE
Beetle, blind cave leiodid	*Glacicavicola bathyscoides*	ID	Invertebrate	BS
Beetle, Bruneau dunes tiger	*Cicindela waynei*	NV	Invertebrate	BS
Beetle, Chiricahua water scavenger	*Cymbiodyta arizonica*	AZ	Invertebrate	BS
Beetle, click	*Cardiophorus* sp.	NV	Invertebrate	BS
Beetle, Columbia River tiger	*Cicindela columbica*	NV	Invertebrate	BS

Common Name	Scientific Name	State[1]	Class	Status[2]
Beetle, coral pink sand dunes tiger	*Cicindela albissima*	UT	Invertebrate	C
Beetle, delta green ground	*Elaphrus viridis*	CA	Invertebrate	FT
Beetle, Devil's Hole Warm Spring riffle	*Stenelmis calida*	ID, NV	Invertebrate	BS
Beetle, Holsinger's Cave	*Pseudanophthalmus holsinger*	AZ	Invertebrate	C
Beetle, Idaho dunes tiger	*Cicindela arenicola*	ID	Invertebrate	BS
Beetle, Maricopa tiger	*Cicindela oregona*	AZ, NV	Invertebrate	BS
Beetle, Moapa Warm Spring riffle	*Stenelmis moapa*	NV	Invertebrate	BS
Beetle, Mount Hermon june	*Polyphylla barbata*	CA	Invertebrate	FE
Beetle, Ohlone tiger	*Cicindela ohlone*	CA	Invertebrate	FE
Beetle, Roth's blind ground	*Pterostichus rothi*	OR	Invertebrate	BS
Beetle, San Joaquin dune	*Coelus gracilis*	CA	Invertebrate	BS
Beetle, Sand Mountain pygmy scarab	*Coenonycha pygmaea*	NV	Invertebrate	BS
Beetle, Siuslaw sand tiger	*Cicindela hirticollis*	OR	Invertebrate	BS
Beetle, valley elderberry longhorn	*Desmocerus californicus dimorphus*	CA	Invertebrate	FT
Bensoniella, Oregon	*Bensoniella oregana*	CA, OR	Plant	BS
Bentgrass, Henderson's	*Agrostis hendersonii*	OR	Plant	BS
Bentgrass, Howell's	*Agrostis howellii*	OR	Plant	BS
Bentgrass, northern	*Agrostis borealis*	OR	Plant	BS
Birds-beak, hispid	*Cordylanthus mollis* ssp. *hispidus*	CA, OR	Plant	BS
Birds-beak, Mount Diablo	*Cordylanthus nidularius*	CA	Plant	BS
Birds-beak, pallid	*Cordylanthus tenuis* ssp. *pallenscens*	CA, NM	Plant	BS
Birds-beak, palmate-bracted	*Cordylanthus palmatus*	CA	Plant	FE
Birds-beak, Pennell's	*Cordylanthus tenuis* ssp. *capillaris*	CA	Plant	FE
Birds-beak, Point Reyes	*Cordylanthus maritimus* ssp. *palustris*	CA, OR	Plant	BS
Birds-beak, salt marsh	*Cordylanthus maritimus* ssp. *maritimus*	CA	Plant	FE
Birds-beak, seaside	*Cordylanthus rigidus*	CA	Plant	BS
Birds-beak, soft	*Cordylanthus mollis* ssp. *mollis*	CA	Plant	FE
Birds-beak, Tecopa	*Cordylanthus tecopensis*	AZ, CA, NV	Plant	BS
Biscuitroot, Canyonlands	*Lomatium latilobum*	CO	Plant	BS
Biscuitroot, Goodrich	*Cymopterus goodrichii*	NV	Plant	BS
Bison, wood	*Bison bison*	AK	Mammal	FE
Bittercress, Constance's	*Cardamine constancei*	ID	Plant	BS
Bittercress, Saddle Mountain	*Cardamine pattersonii*	OR	Plant	BS

Common Name	Scientific Name	State[1]	Class	Status[2]
Bitterweed, Richardson's	*Hymenoxys richardsonii*	ID	Plant	BS
Blackbird, rusty	*Euphagus carolinus*	AK	Bird	BS
Blackbird, tricolored	*Agelaius tricolor*	CA, OR	Bird	BS
Blackbird, yellow-headed	*Xanthocephalus xanthocephalus*	ID	Bird	BS
Bladderpod, beautiful	*Lesquerella pulchella*	MT	Plant	BS
Bladderpod, Calder's	*Lesquerella calderi*	AK	Plant	BS
Bladderpod, cushion	*Physaria pulvinata*	CO	Plant	BS
Bladderpod, double	*Physaria brassicoides*	MT	Plant	BS
Bladderpod, Dudley Bluffs	*Lesquerella congesta*	CO	Plant	FT
Bladderpod, Fremont	*Lesquerella fremontii*	WY	Plant	BS
Bladderpod, Idaho	*Lesquerella carinata*	MT	Plant	BS
Bladderpod, Kodachrome	*Lesquerella tumulosa*	UT	Plant	FE
Bladderpod, large-fruited	*Lesquerella macrocarpa*	WY	Plant	BS
Bladderpod, pagosa	*Lesquerella pruinosa*	CO	Plant	BS
Bladderpod, Piceance	*Lesquerella parviflora*	CO	Plant	BS
Bladderpod, prostrate	*Lesquerella prostrata*	WY	Plant	BS
Bladderpod, Pryor Mountains	*Lesquerella lesicii*	MT	Plant	BS
Bladderpod, Salmon twin	*Physaria didymocarpa*	ID, MT	Plant	BS
Bladderpod, San Bernardino Mountains	*Lesquerella kingii*	CA	Plant	FE
Bladderpod, sidesaddle	*Lesquerella arenosa*	WY	Plant	BS
Bladderpod, Uncompaghre	*Lesquerella vicina*	CO	Plant	BS
Bladderpod, western	*Lesquerella multiceps*	WY	Plant	BS
Bladderpod, White Bluffs	*Physaria tuplashensis*	OR	Plant	FT
Bladderwort, flat-leaved	*Utricularia intermedia*	OR	Plant	BS
Bladderwort, humped	*Utricularia gibba*	OR	Plant	BS
Bladderwort, lesser	*Utricularia minor*	OR	Plant	BS
Bladderwort, northern	*Utricularia ochroleuca*	OR	Plant	BS
Blazingstar, Ash Meadows	*Mentzelia leucophylla*	NV	Plant	FT
Blazingstar, creamy	*Mentzelia tridentata*	CA	Plant	BS
Blazingstar, golden	*Mentzelia chrysantha*	CO	Plant	BS
Blazingstar, Inyo	*Mentzelia inyoensis*	CA	Plant	BS
Blazingstar, Pioche	*Mentzelia argillicola*	NV	Plant	BS
Blazingstar, polished	*Mentzelia polita*	CA, NV	Plant	BS
Blazingstar, Roan Cliffs	*Mentzelia rhizomata*	CO	Plant	BS
Blazingstar, Royal Gorge	*Mentzelia densa*	CO	Plant	BS
Blazingstar, Tiehm's	*Mentzelia tiehmii*	NV	Plant	BS
Blazingstar, united	*Mentzelia congesta*	OR	Plant	BS
Bleedingheart, few-flowered	*Dicentra pauciflora*	OR	Plant	BS
Blue, Great Basin small	*Philotiella speciosa*	NV	Invertebrate	BS
Blue, Sand Mountain	*Euphilotes palliscens*	NV	Invertebrate	BS

Common Name	Scientific Name	State[1]	Class	Status[2]
Bluebell, Drummond's	*Mertensia drummondii*	AK	Plant	BS
Blueberry, velvet-leaf	*Vaccinium myrtilloides*	OR	Plant	BS
Bluecup, Mission Canyon	*Githopsis diffusa*	CA	Plant	BS
Bluecurls, Hidden Lake	*Trichostema austromontanum*	CA	Plant	FT
Blue-eyed grass, St. George	*Sisyrinchium radicatum*	NV	Plant	BS
Blue-eyed, grass pale #1	*Sisyrinchium sarmentosum*	OR	Plant	BS
Blue-eyed, grass pale #2	*Sisyrinchium pallidum*	CO, WY	Plant	BS
Bluegrass, Hart's	*Poa hartzii*	AK	Plant	BS
Bluegrass, loose-flowered	*Poa laxiflora*	OR	Plant	BS
Bluegrass, Napa	*Poa napensis*	CA	Plant	FE
Bluegrass, ocean-bluff	*Poa unilateralis*	OR	Plant	BS
Bluegrass, Porsild's	*Poa porsildii*	AK	Plant	BS
Bluegrass, San Bernardino	*Poa atropurpurea*	CA	Plant	FE
Bluegrass, short-leaved	*Poa arnowiae*	MT	Plant	BS
Bluegrass, timber	*Poa rhizomata*	OR	Plant	BS
Blue-star, Jones	*Amsonia jonesii*	CO	Plant	BS
Blue-star, Kearney's	*Amsonia kearneyana*	AZ, CA	Plant	FE
Bluestar, Peeble's	*Amsonia peeblesii*	AZ, WY	Plant	BS
Bluestem, little	*Schizachyrium scoparium*	OR	Plant	BS
Boa, rosy	*Lichanura trivirgata*	AZ, CA	Reptile	BS
Bobolink	*Dolichonyx orysivorus*	OR, MT, UT	Bird	BS
Bobwhite, masked (quail)	*Colinus virginianus*	AZ	Bird	FE
Bog-orchid, canyon	*Platanthera sparsiflora*	OR	Plant	BS
Bog-orchid, choris	*Platanthera chorisiana*	OR	Plant	BS
Bog-orchid, small northern	*Platanthera obtusata*	OR	Plant	BS
Bolandra, Oregon	*Bolandra oregana*	OR	Plant	BS
Bolete, red-pored	*Boletus haematinus*	CA	Plant	BS
Boneset, western	*Ageratina occidentalis*	MT	Plant	BS
Breadroot, aromatic Indian	*Pediomelum aromaticum*	CO	Plant	BS
Breadroot, Beaver Dam	*Pediomelum castoreum*	NV	Plant	BS
Breadroot, Chihuahua	*Pediomelum pentaphyllum*	AZ	Plant	BS
Breadroot, Indian	*Pediomelum hypogaeum*	MT	Plant	BS
Brickellbush, Mohave	*Brickellia oblongifolia*	MT	Plant	BS
Bristlemoss, Shevock	*Orthotrichum shevockii*	CA, NV	Plant	BS
Brittlebrush, annual	*Psathyrotes annua*	ID, WY	Plant	BS
Brodiaea, Chinese Camp	*Brodiaea pallida*	CA	Plant	FT
Brodiaea, dwarf	*Brodiaea terrestris*	OR	Plant	BS
Brodiaea, Indian Valley	*Brodiaea coronaria*	CA	Plant	BS
Brodiaea, Kaweah	*Brodiaea insignis*	CA	Plant	BS
Brodiaea, Leach's	*Triteleia hendersonii*	OR	Plant	BS
Brodiaea, Orcutt's	*Brodiaea orcuttii*	CA	Plant	BS
Brodiaea, thread-leaved	*Brodiaea filifolia*	CA	Plant	FT

Common Name	Scientific Name	State[1]	Class	Status[2]
Broom, round-leaf	*Errazurizia rotundata*	AZ	Plant	BS
Broom, San Clemente Island	*Lotus dendroideus*	CA	Plant	FE
Bryum, beautiful	*Bryum calobryoides*	ID, OR	Plant	BS
Buckwheat	*Eriogonum* sp.	CA	Plant	BS
Buckwheat, altered andesite	*Eriogonum robustum*	NV	Plant	BS
Buckwheat, Beatley	*Eriogonum beatleyae*	NV	Plant	BS
Buckwheat, blushing wild	*Eriogonum ursinum*	CA	Plant	BS
Buckwheat, Brandegee's wild	*Eriogonum brandegeei*	CO	Plant	BS
Buckwheat, calcareous	*Eriogonum ochrocephalum*	ID	Plant	BS
Buckwheat, Churchill Narrows	*Eriogonum diatomaceum*	NV	Plant	C
Buckwheat, Clay Hill	*Eriogonum viridulum*	CO	Plant	BS
Buckwheat, clay-loving wild	*Eriogonum pelinophilum*	CA, CO	Plant	FE
Buckwheat, Clokey's	*Eriogonum heermannii*	NV	Plant	BS
Buckwheat, Colorado wild	*Eriogonum coloradense*	CO	Plant	BS
Buckwheat, Comb Wash	*Eriogonum clavellatum*	CO	Plant	BS
Buckwheat, Crosby's	*Eriogonum crosbyae*	CA, NV, OR	Plant	BS
Buckwheat, Cushenbury	*Eriogonum ovalifolium* var. *vineum*	AZ, CA	Plant	FE
Buckwheat, Cusick's	*Eriogonum cusickii*	OR	Plant	BS
Buckwheat, Darin	*Eriogonum concinnum*	NV	Plant	BS
Buckwheat, Deer Lodge	*Eriogonum pharnaceoides*	NV	Plant	BS
Buckwheat, Deeth	*Eriogonum nutans*	NV	Plant	BS
Buckwheat, desert	*Eriogonum desertorum*	CO	Plant	BS
Buckwheat, ephedra	*Eriogonum ephedroides*	CO	Plant	BS
Buckwheat, forked (Pahrump Valley buckwheat)	*Eriogonum bifurcatum*	CA, NV	Plant	BS
Buckwheat, Frisco	*Eriogonum soredium*	UT	Plant	C
Buckwheat, golden	*Eriogonum chrysops*	OR	Plant	BS
Buckwheat, grand	*Eriogonum contortum*	CO, OR	Plant	BS
Buckwheat, green	*Eriogonum umbellatum*	CA, OR	Plant	BS
Buckwheat, Hoffmann's	*Eriogonum hoffmannii*	CA	Plant	BS
Buckwheat, Hooker's wild	*Eriogonum hookeri*	OR	Plant	BS
Buckwheat, Ione	*Eriogonum apricum*	CA	Plant	FE
Buckwheat, Kern	*Eriogonum kennedyi*	CA	Plant	BS
Buckwheat, Klamath Mountains	*Eriogonum hirtellum*	CA	Plant	BS
Buckwheat, Las Vegas	*Eriogonum corymbosum*	NV, UT	Plant	C
Buckwheat, Lewis	*Eriogonum lewisii*	NV	Plant	BS
Buckwheat, Lobb's	*Eriogonum lobbii*	OR	Plant	BS
Buckwheat, Lunar Crater	*Johannesshowellia crateriorum*	NV	Plant	BS
Buckwheat, matted	*Eriogonum caespitosum*	MT	Plant	BS
Buckwheat, matted cowpie	*Eriogonum shockleyi* var. *shockleyi*	ID	Plant	BS

Common Name	Scientific Name	State[1]	Class	Status[2]
Buckwheat, mouse	*Eriogonum nudum*	CA	Plant	BS
Buckwheat, Packard's cowpie	*Eriogonum shockleyi* var. *packardiae*	ID	Plant	BS
Buckwheat, Panamint Mountains	*Eriogonum microthecum*	CA	Plant	BS
Buckwheat, Pinyon mesa	*Eriogonum mensicola*	CA	Plant	BS
Buckwheat, Piute	*Eriogonum breedlovei*	CA	Plant	BS
Buckwheat, playa	*Eriogonum salicornioides*	OR	Plant	BS
Buckwheat, prostrate	*Eriogonum prociduum*	CA, NV, OR	Plant	BS
Buckwheat, Railroad Canyon wild	*Eriogonum soliceps*	MT	Plant	BS
Buckwheat, Red Mountain	*Eriogonum kelloggii*	CA, UT	Plant	C
Buckwheat, Reveal's	*Eriogonum contiguum*	CA	Plant	BS
Buckwheat, San Carlos wild	*Eriogonum capillare*	NM	Plant	BS
Buckwheat, San Pedro River wild	*Eriogonum terrenatum*	AZ	Plant	BS
Buckwheat, Scarlet	*Eriogonum microthecum* var. *phoeniceum*	NV	Plant	BS
Buckwheat, Schoolcraft's	*Eriogonum microthecum* var. *schoolcraftii*	CA, NV	Plant	BS
Buckwheat, single-stemmed wild	*Eriogonum acaule*	CO	Plant	BS
Buckwheat, smooth	*Stenogonum salsuginosum*	MT	Plant	BS
Buckwheat, Snow Mountain	*Eriogonum nervulosum*	CA, OR	Plant	BS
Buckwheat, southern mountain wild	*Eriogonum kennedyi* var. *austromontanum*	CA	Plant	FT
Buckwheat, Steamboat	*Eriogonum ovalifolium* var. *williamsiae*	NV	Plant	FE
Buckwheat, sticky	*Eriogonum viscidulum*	AZ, NV	Plant	BS
Buckwheat, Temblor	*Eriogonum temblorense*	CA	Plant	BS
Buckwheat, Thorne's	*Eriogonum thornei*	CA	Plant	BS
Buckwheat, Tiehm's	*Eriogonum tiehmii*	NV	Plant	BS
Buckwheat, Umtanum desert	*Eriogonum codium*	OR	Plant	FT
Buckwheat, Visher's	*Eriogonum visheri*	MT	Plant	BS
Buckwheat, Welsh's	*Eriogonum capistratum*	ID	Plant	BS
Buckwheat, Wild Rose Canyon	*Eriogonum eremicola*	CA	Plant	BS
Buckwheat, windloving	*Eriogonum anemophilum*	NV	Plant	BS
Buckwheat, woodside	*Eriogonum tumulosum*	CO	Plant	BS
Bufflehead	*Bucephala albeola*	OR	Bird	BS
Bug, hairy shore	*Saldula villosa*	OR	Invertebrate	BS
Bug, Harney Hot Spring shore	*Micracanthia fennica*	OR	Invertebrate	BS
Bug, Oregon plant	*Lygus oregonae*	OR	Invertebrate	BS
Bug, Pahranagat Naucorid	*Pelocoris shoshone shoshone*	NV, OR	Invertebrate	BS
Bug, Santa Rita Mountains chlorochroan	*Chlorochroa rita*	AZ	Invertebrate	BS

Common Name	Scientific Name	State[1]	Class	Status[2]
Bugbane, tall	*Cimicifuga elata*	OR	Plant	BS
Bug-on-a-stick, leafless	*Buxbaumia aphylla*	OR	Invertebrate	BS
Bug-on-a-stick, pipers	*Buxbaumia piperi*	CA	Invertebrate	BS
Bugseed, crescent	*Corispermum navicula*	CO	Plant	BS
Bulrush, drooping	*Scirpus pendulus*	OR	Plant	BS
Bulrush, little	*Scirpus rollandii*	CO	Plant	BS
Bulrush, Rolland's	*Trichophorum pumilum*	CO	Plant	BS
Bulrush, slender	*Schoenoplectus heterochaetus*	MT	Plant	BS
Bumblebee, Franklin's	*Bombus franklini*	OR	Invertebrate	BS
Bunting, Mckay's	*Plectrophenax hyperboreus*	AK	Bird	BS
Bupleurum	*Bupleurum americanum*	OR	Plant	BS
Burbot	*Lota lota*	ID	Fish	BS
Bush, gentry indigo	*Dalea tentaculoides*	AZ	Plant	BS
Bush, iodine	*Allenrolfea occidentalis*	OR	Plant	BS
Bush, Marble Canyon indigo	*Psorothamnus arborescens*	AZ	Plant	BS
Bush-mallow, Arroyo Seco	*Malacothamnus palmeri*	CA	Plant	BS
Bush-mallow, San Clemente Island	*Malacothamnus clementinus*	CA	Plant	FE
Bush-mallow, Santa Cruz Island	*Malacothamnus fasciculatus*	CA	Plant	FE
Buttercup, autumn	*Ranunculus aestivalis*	UT	Plant	FE
Buttercup, California	*Ranunculus californicus*	OR	Plant	BS
Buttercup, Cooley's	*Ranunculus cooleyae*	OR	Plant	BS
Buttercup, glacier	*Ranunculus glacialis* var. *camissonis*	AK	Plant	BS
Buttercup, glacier	*Ranunculus glacialis*	AK	Plant	BS
Buttercup, mountain	*Ranunculus populago*	OR	Plant	BS
Buttercup, northern	*Ranunculus pedatifidus*	MT	Plant	BS
Buttercup, obscure	*Ranunculus triternatus*	NV, OR	Plant	BS
Buttercup, sagebrush	*Ranunculus reconditus*	OR	Plant	BS
Buttercup, southern Oregon	*Ranunculus austrooreganus*	OR	Plant	BS
Buttercup, Turner's	*Ranunculus turneri*	AK	Plant	BS
Butterfly, baking powder flat blue	*Euphilotes bernardino minuta*	NV	Invertebrate	BS
Butterfly, bay checkerspot	*Euphydryas editha bayensis*	CA	Invertebrate	FT
Butterfly, Behren's silverspot	*Speyeria zerene behrensii*	CA	Invertebrate	FE
Butterfly, Callippe silverspot	*Speyeria callippe callippe*	CA	Invertebrate	FE
Butterfly, early blue	*Euphilotes enoptes*	NV	Invertebrate	BS
Butterfly, El Segundo blue	*Euphilotes battoides allyni*	CA	Invertebrate	FE
Butterfly, Fender's blue	*Icaricia icarioides fenderi*	OR	Invertebrate	FE
Butterfly, Great Basin silverspot	*Speyeria nokomis*	AZ, CO, NV, UT	Invertebrate	BS
Butterfly, insular blue	*Plebejus saepiolus insulanus*	OR	Invertebrate	BS
Butterfly, Lange's metalmark	*Apodemia mormo langei*	CA	Invertebrate	FE

Common Name	Scientific Name	State[1]	Class	Status[2]
Butterfly, lotis blue	*Lycaeides argyrognomon lotis*	CA	Invertebrate	FE
Butterfly, Mattoni's blue	*Euphilotes palliscens mattoni*	NV	Invertebrate	BS
Butterfly, mission blue	*Icaricia icarioides missionensis*	CA	Invertebrate	FE
Butterfly, Mount Charleston blue	*Plebejus shasta charlestonensis*	NV	Invertebrate	BS
Butterfly, Myrtle's silverspot	*Speyeria zerene myrtleae*	CA	Invertebrate	FE
Butterfly, Oregon silverspot	*Speyeria zerene hippolyta*	CA, OR	Invertebrate	FT
Butterfly, Palos Verdes blue	*Glaucopsyche lygdamus palosverdesensis*	CA	Invertebrate	FE
Butterfly, Quino checkerspot	*Euphydryas editha quino*	CA	Invertebrate	FE
Butterfly, Rice's blue	*Euphilotes palliscens ricei*	NV	Invertebrate	BS
Butterfly, San Bruno elfin	*Callophrys mossii bayensis*	CA	Invertebrate	FE
Butterfly, Smith's blue	*Euphilotes enoptes smithii*	CA	Invertebrate	FE
Butterfly, Spring Mountains dark blue	*Euphilotes ancilla cryptica*	NV	Invertebrate	BS
Butterfly, Spring Mountains icarioides blue	*Plebejus icarioides austinorum*	NV	Invertebrate	BS
Butterfly, Taylor's checkerspot	*Euphydryas editha taylori*	OR	Invertebrate	FE
Butterfly, Thorne's hairstreak	*Mitoura thornei*	CA	Invertebrate	BS
Butterfly, Uncompahgre fritillary	*Boloria acrocnema*	CO	Invertebrate	FE
Butterfly plant, Colorado	*Gaura neomexicana* var. *coloradensis*	CA, CO, WY	Plant	FT
Butterweed, Gander's	*Packera ganderi*	CA	Plant	BS
Butterweed, Layne's	*Senecio layneae*	CA	Plant	FT
Button-celery, San Diego	*Eryngium aristulatum*	CA	Plant	FE
Cabbage, slender wild	*Caulanthus major*	OR	Plant	BS
Cabbage, smooth wild	*Caulanthus crassicaulis*	OR	Plant	BS
Cactus, Acuna	*Echinomastus erectocentrus* var. *acunensis*	AZ	Plant	FE
Cactus, Bakersfield	*Opuntia treleasei*	CA	Plant	FE
Cactus, bracks	*Sclerocactus cloveriae*	NM	Plant	BS
Cactus, Colorado hookless	*Sclerocactus glaucus*	CO, UT	Plant	FT
Cactus, cushion	*Coryphantha vivipara*	ID	Plant	BS
Cactus, Duncan's cory	*Coryphantha duncanii*	NM	Plant	BS
Cactus, Fickeisen Plains	*Pediocactus peeblesianus* var. *fickeiseniae*	AZ	Plant	FE
Cactus, Knowlton's	*Pediocactus knowltonii*	CO, NM	Plant	FE
Cactus, Mesa Cerde	*Sclerocactus mesae-verdae*	CO, NM, UT	Plant	FT
Cactus, Nichol's Turk's head	*Echinocactus horizonthalonius* var. *nicholli*	AZ	Plant	FE
Cactus, Pariette	*Sclerocactus brevispinus*	UT	Plant	FT

Common Name	Scientific Name	State[1]	Class	Status[2]
Cactus, Peebles Navajo	*Pediocactus peeblesianus* var. *peeblesianus*	AZ	Plant	FE
Cactus, Pima Pineapple	*Coryphantha scheeri* var. *robustispina*	AZ	Plant	FE
Cactus, San Rafael	*Pediocactus despainii*	NM, UT	Plant	FE
Cactus, Winkler	*Pediocactus winkleri*	UT	Plant	FT
Caddisfly, a	*Rhyacophila chandleri*	OR	Invertebrate	BS
Caddisfly, Haddock's rhyacophilan	*Rhyacophila haddocki*	ID, OR	Invertebrate	BS
Caddisfly, Scott's apatanian	*Allomyia scotti*	OR	Invertebrate	BS
Calicoflower, harlequin	*Downingia insignis*	ID	Plant	BS
Calycadenia, dwarf	*Calycadenia villosa*	CA	Plant	BS
Calycadenia, Hoover's	*Calycadenia hooveri*	CA	Plant	BS
Calycadenia, small-flowered	*Calycadenia micrantha*	CA	Plant	BS
Camas, Cusick's	*Camassia cusickii*	ID	Plant	BS
Camas, Howell's	*Camassia howellii*	OR	Plant	BS
Camas, small-flowered death	*Zigadenus fontanus*	OR	Plant	BS
Camissonia, small	*Camissonia parvula*	MT	Plant	BS
Campion, long-stiped	*Silene occidentalis*	CA	Plant	BS
Campion, Red Mountain	*Silene campanulata*	CA	Plant	BS
Candle, miner's	*Cryptantha scoparia*	MT, OR	Plant	BS
Candle, Owl Creek miner's	*Cryptantha subcapitata*	WY	Plant	BS
Candystick	*Allotropa virgata*	ID	Plant	BS
Caribou, woodland	*Rangifer tarandus caribou*	ID, OR	Mammal	FE
Catchfly, Bolander's	*Silene hookeri*	OR	Plant	BS
Catchfly, Jan's	*Silene nachlingerae*	NV	Plant	BS
Catchfly, Spalding's	*Silene spaldingii*	ID, MT, OR	Plant	FT
Catfish, Yaqui	*Ictalurus pricei*	AZ	Fish	FT
Catseye, Fendler's	*Cryptantha fendleri*	MT	Plant	BS
Catseye, Gypsum Valley	*Cryptantha gypsophila*	CO	Plant	BS
Catseye, Shacklette's	*Cryptantha shackletteana*	AK	Plant	BS
Catseye, smooth	*Crypthantha semiglabra*	AZ	Plant	BS
Catseye, unusual	*Cryptantha insolita*	NV	Plant	BS
Caulostramina, Jaeger's	*Caulostramina jaegeri*	CA	Plant	BS
Ceanothus, Calistoga	*Ceanothus divergens*	CA	Plant	BS
Ceanothus, coyote	*Ceanothus ferrisae*	CA	Plant	FE
Ceanothus, Hearst's	*Ceanothus hearstiorum*	CA	Plant	BS
Ceanothus, lakeside	*Ceanothus cyaneus*	CA	Plant	BS
Ceanothus, Mahala-mat	*Ceanothus prostratus*	ID	Plant	BS
Ceanothus, Monterey	*Ceanothus cuneatus*	CA	Plant	BS
Ceanothus, Pine Hill	*Ceanothus roderickii*	CA	Plant	FE
Ceanothus, Rincon Ridge	*Ceanothus confusus*	CA	Plant	BS

Common Name	Scientific Name	State[1]	Class	Status[2]
Ceanothus, Vail Lake	*Ceanothus ophiochilus*	CA	Plant	FT
Cedar, ground	*Lycopodium complanatum*	OR	Plant	BS
Centaury, spring-loving	*Centaurium namophilum*	CA, NV	Plant	FT
Cereus, desert night-blooming	*Cereus greggii*	CA, NM	Plant	BS
Chaenactis, desert	*Chaenactis xantiana*	OR	Plant	BS
Chaenactis, Shasta	*Chaenactis suffrutescens*	CA	Plant	BS
Chaenactis, Thompson's	*Chaenactis thompsonii*	OR	Plant	BS
Chanterelle, blue	*Polyozellus multiplex*	CA	Plant	BS
Char, arctic (Kigluaik Mountains)	*Salvelinus alpinus*	AK	Fish	BS
Chat, yellow-brested	*Icteria virens*	CO	Bird	BS
Checkerbloom, coast	*Sidalcea oregana* ssp. *eximia*	CA, OR	Plant	BS
Checkerbloom, Cuesta Pass	*Sidalcea hickmanii* ssp. *anomala*	CA	Plant	BS
Checkerbloom, dwarf	*Sidalcea malviflora*	CA, OR	Plant	BS
Checkerbloom, Hickman's	*Sidalcea hickmanii* ssp. *hickmanii*	OR	Plant	BS
Checkerbloom, Owens Valley	*Sidalcea covillei*	CA	Plant	BS
Checkerbloom, Parish's	*Sidalcea hickmanii* ssp. *parshii*	CA	Plant	C
Checker-mallow, Butte County	*Sidalcea robusta*	CA	Plant	BS
Checker-mallow, Keck's	*Sidalcea keckii*	CA, UT	Plant	FE
Checker-mallow, Kenwood Marsh	*Sidalcea oregana* ssp. *valida*	CA	Plant	FE
Checker-mallow, meadow	*Sidalcea campestris*	OR	Plant	BS
Checker-mallow, Nelson's	*Sidalcea nelsoniana*	OR	Plant	FT
Checker-mallow, pedate	*Sidalcea pedata*	CA	Plant	FE
Checker-mallow, Wenatchee Mountains	*Sidalcea oregana* var. *calva*	OR	Plant	FE
Checkerspot, Spring Mountain acastus	*Chlosyne acastus*	NV	Invertebrate	BS
Chickweed, creeping	*Stellaria humifusa*	OR	Plant	BS
Chicory, California	*Rafinesquia californica*	OR	Plant	BS
Chinquapin, golden	*Chrysolepis chrysophylla*	OR	Plant	BS
Chipmunk, gray-footed	*Tamias canipes*	NM	Mammal	BS
Chipmunk, Organ Mountains Colorado	*Eutamias quadrivittatus australis*	NM	Mammal	BS
Chipmunk, red-tailed	*Tamias ruficaudus*	OR	Mammal	BS
Cholla, Blue Diamond	*Opuntia whipplei* var. *multigeniculata*	NV	Plant	BS
Cholla, Munz	*Cylindropuntia munzii*	CA	Plant	BS
Cholla, sand	*Grusonia pulchella*	NV	Plant	BS
Chub, Alvord	*Gila alvordensis*	OR	Fish	BS

Common Name	Scientific Name	State[1]	Class	Status[2]
Chub, bonytail	*Gila elegans*	AZ, CA, CO, NV, UT, WY	Fish	FE
Chub, Borax Lake	*Gila boraxobius*	OR	Fish	FE
Chub, Catlow tui	*Gila bicolor* ssp.	OR	Fish	BS
Chub, Chihuahua	*Gila nigrescens*	NM	Fish	FT
Chub, Cowhead Lake tui	*Gila bicolor* ssp.	CA	Fish	FP
Chub, Fish Lake Valley tui	*Gila bicolor* ssp.	NV	Fish	BS
Chub, flathead	*Platygobio gracilis*	CO, NM	Fish	BS
Chub, Gila	*Gila intermedia*	AZ, NM	Fish	FE
Chub, Goose Lake tui	*Gila bicolor thalassina*	OR	Fish	BS
Chub, headwater	*Gila nigra*	AZ, NM	Fish	C
Chub, hornyhead	*Nocomis biguttahtus*	WY	Fish	BS
Chub, Hot Creek Valley tui	*Gila bicolor* ssp.	NV	Fish	BS
Chub, humpback	*Gila cypha*	AZ, CO, UT, WY	Fish	FE
Chub, Hutton tui	*Gila bicolor* ssp.	OR	Fish	FT
Chub, Independence Valley tui	*Gila bicolor isolata*	NV	Fish	BS
Chub, least	*Iotichthys phlegethontis*	NM, UT	Fish	C
Chub, leatherside	*Gila copei*	ID, UT, WY	Fish	BS
Chub, Mohave tui	*Gila bicolor mohavensis*	CA	Fish	FE
Chub, Newark Valley Tui	*Lepidomeda copei*	NV, UT, WY	Fish	BS
Chub, northern leatherside	*Gila bicolor newarkensis*	NV	Fish	BS
Chub, Oregon	*Oregonichthys crameri*	OR	Fish	FT
Chub, Oregon Lakes tui	*Gila bicolor oregonensis*	OR	Fish	BS
Chub, Owen's tui	*Gila bicolor snyderi*	CA	Fish	FE
Chub, Pahranagat roundtail	*Gila robusta jordani*	NV	Fish	FE
Chub, railroad valley Tui	*Gila pandora*	CO	Fish	BS
Chub, Rio Grande	*Gila bicolor* ssp.	NV	Fish	BS
Chub, roundtail	*Gila robusta*	AZ, CO, NM, UT, WY	Fish	C
Chub, Sheldo tui	*Gila bicolor eurysoma*	OR	Fish	C
Chub, sicklefin	*Machrybopsis meeki*	ID, OR	Fish	BS
Chub, Sonora	*Gila ditaenia*	AZ	Fish	FT
Chub, southern leatherside	*Lepidomeda aliciae*	UT	Fish	BS
Chub, sturgeon	*Machrybopsis gelida*	ID, MT, UT	Fish	BS
Chub, Summer Basin tui	*Gila bicolor* ssp.	OR	Fish	BS
Chub, Umpqua Oregon	*Oregonichthys kalawatseti*	OR	Fish	BS
Chub, Virgin River	*Gila seminuda*	AZ, NV, UT	Fish	FE
Chub, Yaqui	*Gila purpurea*	AZ	Fish	FE
Chuckwalla	*Sauromalus ater*	AZ, NV, UT	Reptile	BS
Chuckwalla, Glen Canyon	*Sauromalus obesus* ssp.	NV, UT	Reptile	BS
Chuckwalla, western	*Sauromalus obesus*	UT	Reptile	BS

Common Name	Scientific Name	State[1]	Class	Status[2]
Cinquefoil, circumpolar	*Potentilla stipularis*	AK	Plant	BS
Cinquefoil, Cottam's	*Potentilla cottamii*	NV	Plant	BS
Cinquefoil, Platte	*Potentilla plattensis*	MT	Plant	BS
Cinquefoil, snow	*Potentilla nivea*	OR	Plant	BS
Cinquefoil, Soldier Meadows	*Potentilla basaltica*	CA, NV	Plant	C
Cladonia	*Cladonia uncialis*	OR	Plant	BS
Clarkia, beaked	*Clarkia rostrata*	CA, OR	Plant	BS
Clarkia, Brandegee's	*Clarkia biloba* ssp. *brandegeeae*	CA	Plant	BS
Clarkia, Caliente (Vasek's clarkia)	*Clarkia tremblorienses* ssp. *caleintensis*	CA	Plant	BS
Clarkia, Enterprise	*Clarkia mosquinii* ssp. *xerophylla*	CA	Plant	BS
Clarkia, Mariposa	*Clarkia biloba*	CA	Plant	BS
Clarkia, Mildred's	*Clarkia mildrediae*	CA	Plant	BS
Clarkia, Mosquin's	*Clarkia mosquinii* ssp. *mosquinii*	CA	Plant	BS
Clarkia, northern	*Clarkia borealis*	CA	Plant	BS
Clarkia, Pismo	*Clarkia speciosa* ssp. *immaculata*	CA	Plant	FE
Clarkia, Presidio	*Clarkia franciscana*	CA	Plant	FE
Clarkia, Shasta	*Clarkia borealis* ssp. *arida*	CA, OR	Plant	BS
Clarkia, small southern	*Clarkia australis*	CA	Plant	BS
Clarkia, Springville	*Clarkia springvillensis*	CA	Plant	FT
Clarkia, Vine Hill	*Clarkia imbricata*	CA	Plant	FE
Clarkia, white-stemmed	*Clarkia gracilis*	CA	Plant	BS
Claytonia, Great Basin	*Claytonia umbellata*	CA	Plant	BS
Cleomella, flat-seeded	*Cleomella plocasperma*	ID	Plant	BS
Cliff-brake, Bridge's	*Pellaea bridgesii*	OR	Plant	BS
Cliffbrake, Sierra	*Pellaea brachyptera*	OR	Plant	BS
Cliff-rose, Arizona	*Purshia subintegra*	AZ	Plant	FE
Clover, Barneby's	*Trifolium barnebyi*	WY	Plant	BS
Clover, Butte County golden	*Trifolium jokerstii*	CA	Plant	BS
Clover, Currant Summit	*Trifolium andinum*	NV	Plant	BS
Clover, Dedecker's	*Trifolium dedeckerae*	CA	Plant	BS
Clover, Douglas	*Trifolium douglasii*	OR	Plant	BS
Clover, Frisco	*Trifolium friscanum*	UT	Plant	C
Clover, Leiberg's	*Trifolium leibergii*	OR	Plant	BS
Clover, Monterey	*Trifolium trichocalyx*	CA	Plant	FE
Clover, mountain	*Trifolium andinum*	CO	Plant	BS
Clover, Owyhee	*Trifolium owyheense*	ID, OR	Plant	BS
Clover, Pacific Grove	*Trifolium polyodon*	CA	Plant	BS
Clover, plumed	*Trifolium plumosum*	CA, WY	Plant	BS

Common Name	Scientific Name	State[1]	Class	Status[2]
Clover, Santa Cruz	*Trifolium buckwestiorum*	CA	Plant	BS
Clover, showy Indian	*Trifolium amoenum*	CA	Plant	FE
Clover, Thompson's	*Trifolium thompsonii*	OR	Plant	BS
Clubmoss, bog	*Lycopodiella inundata*	OR	Plant	BS
Clubmoss, treelike	*Lycopodium dendroideum*	OR	Plant	BS
Clubrush, water	*Schoenoplectus subterminalis*	OR	Plant	BS
Collinsia, few-flowered	*Collinsia sparsiflora*	OR	Plant	BS
Collinsia, San Antonio	*Collinsia antonina*	CA	Plant	BS
Collomia, Barren Valley	*Collomia renacta*	CO, NV	Plant	BS
Collomia, bristle-flowered	*Collomia macrocalyx*	OR	Plant	BS
Collomia, Mount Mazama	*Collomia mazama*	ID, OR	Plant	BS
Collybia, branched	*Collybia racemosa*	CA	Plant	BS
Columbine, Laramie	*Aquilegia laramiensis*	OR, WY	Plant	BS
Columbine, Rydberg's golden	*Aquilegia chrysantha*	CO, ID	Plant	BS
Columbine, Sitka	*Aquilegia formosa*	MT	Plant	BS
Combleaf, desert	*Polyctenium fremontii*	OR	Plant	BS
Combleaf, William's	*Polyctenium williamsiae*	CA, NV, OR	Plant	BS
Condor, California	*Gymnogyps californianus*	AZ, CA, UT	Bird	XN, FE
Copper, Hermes	*Lycaena hermes*	CA	Invertebrate	C
Coral, hairy-stemmed	*Clavulina castanopes*	CA	Plant	BS
Coral, strap	*Clavariadelphus ligula*	CA	Plant	BS
Coralroot, Chisos Mountains	*Hexalectris revoluta*	AZ, OR	Plant	BS
Coralroot, purple-spike	*Hexalectris warnockii*	AZ, CO	Plant	BS
Cordgrass, prairie	*Spartina pectinata*	OR	Plant	BS
Coreopsis, Mount Hamilton	*Coreopsis hamiltonii*	CA	Plant	BS
Cornsnake	*Elaphe guttata*	UT	Reptile	BS
Corwnscale, San Jacinto Valley	*Atriplex coronata*	CA	Plant	FE
Corydalis, Case's	*Corydalis caseana*	ID	Plant	BS
Cotton-grass, green keeled	*Eriophorum viridicarinatum*	OR	Plant	BS
Cotton-grass, russet	*Eriophorum chamissonis*	OR	Plant	BS
Cotton-grass, slender	*Eriophorum gracile*	CO	Plant	BS
Coyote-thistle, Loch Lomond	*Eryngium constancei*	CA	Plant	FE
Coyote-thistle, Oregon	*Eryngium petiolatum*	OR	Plant	BS
Crane, greater Sandhill	*Grus canadensis tabida*	CA	Bird	BS
Crane, Sandhill	*Grus canadensis*	OR	Bird	BS
Crane, whooping	*Grus americana*	CO, ID, MT, WY	Bird	FE, XN
Crayfish, Shasta	*Pacifastacus fortis*	CA	Invertebrate	FE
Crazyweed, challis	*Oxytropis besseyi*	ID	Plant	BS
Crazyweed, Columbia	*Oxytropis campestris* var. *columbiana*	OR	Plant	BS
Crazyweed, slender	*Oxytropis campestris*	OR	Plant	BS

Common Name	Scientific Name	State[1]	Class	Status[2]
Crazyweed, Wanapum	*Oxytropis campestris* var. *wanapum*	OR	Plant	BS
Creamsacs, pink	*Castilleja rubicundula* ssp. *rubicundula*	CA	Plant	BS
Crescentspot, Steptoe Valley	*Phyciodes cocyta arenacolor*	NV	Invertebrate	BS
Cress, Bodie Hills rock	*Arabis bodiensis*	CA	Plant	BS
Cricket, Arizona giant sand treader	*Daihinibaenetes arizonensis*	AZ	Invertebrate	BS
Cricket, Mary's Peak ice	*Grylloblatta* sp.	OR	Invertebrate	BS
Cricket, Navajo Jerusalem	*Stenopelmatus navajo*	AZ	Invertebrate	BS
Croton, Wiggins	*Croton wigginsii*	CA	Plant	BS
Crownbeard, big-leaved	*Verbesina dissita*	CA	Plant	FT
Cryptantha, beaked	*Cryptantha rostellata*	OR	Plant	BS
Cryptantha, bristlecone	*Cryptantha roosiorum*	CA	Plant	BS
Cryptantha, Clokey's	*Cryptantha clokeyi*	CA	Plant	BS
Cryptantha, deep-scarred	*Cryptantha excavata*	CA	Plant	BS
Cryptantha, Gander's	*Cryptantha ganderi*	CA	Plant	BS
Cryptantha, gray	*Cryptantha leucophaea*	OR	Plant	BS
Cryptantha, Mariposa	*Cryptantha mariposae*	CA	Plant	BS
Cryptantha, Milo Baker's	*Cryptantha milo-bakeri*	OR	Plant	BS
Cryptantha, narrow-stem	*Cryptantha gracilis*	OR	Plant	BS
Cryptantha, Osterhout	*Cryptantha osterhoutii*	CO	Plant	BS
Cryptantha, Rollins'	*Cryptantha rollinsii*	CO	Plant	BS
Cryptantha, Schoolcraft's	*Cryptantha schoolcraftii*	CA, NV	Plant	BS
Cryptantha, seaside	*Cryptantha leiocarpa*	OR	Plant	BS
Cryptantha, serpentine	*Cryptantha clevelandii*	CA	Plant	BS
Cryptantha, silky	*Cryptantha crinita*	CA, WY	Plant	BS
Cryptantha, Snake River	*Cryptantha spiculifera*	OR	Plant	BS
Cryptantha, tufted	*Cryptantha caespitosa*	CO, ID	Plant	BS
Crytpantha, Unita Basin	*Cryptantha breviflora*	ID	Plant	BS
Cuckoo, black-billed	*Coccyzus erythropthelmus*	ID	Bird	BS
Cuckoo, yellow-billed (western DPS)	*Coccyzus americanus*	AZ, CA, CO, ID, MT, NM, NV, OR, UT, WY	Bird	FT
Cui-ui	*Chasmistes cujus*	NV	Fish	FE
Curlew, bristle-thighed	*Numenius tahitiensis*	AK	Bird	BS
Curlew, Eskimo	*Numenius borealis*	AK, MT	Bird	FE
Curlew, long billed	*Numenius americanus*	CO, ID, MT, UT, WY, OR	Bird	BS
Currant, Moreno San Diego	*Ribes canthariforme*	CA	Plant	BS
Currant, wax	*Ribes cereum*	OR	Plant	BS
Currant, Wolf's	*Ribes wolfii*	ID	Plant	BS

Common Name	Scientific Name	State[1]	Class	Status[2]
Cusickiella, Bodie Hills	*Cusickiella quadricostata*	CA, NV, WY	Plant	BS
Cycladenia, Jones	*Cycladenia humilis* var. *jonesii*	AZ, CA, UT	Plant	FT
Cymopterus, desert	*Cymopterus deserticola*	CA	Plant	BS
Cymopterus, Greeley's	*Cymopterus acaulis*	ID, OR	Plant	BS
Cymopterus, purple	*Cymopterus purpurascens*	OR	Plant	BS
Cymopterus, Ripley's	*Cymopterus ripleyi*	CA	Plant	BS
Cyperus, short-pointed	*Cyperus acuminatus*	OR	Plant	BS
Cypress, Baker's	*Cupressus bakeri*	OR	Plant	BS
Cypress, gowen	*Cupressus goveniana*	CA	Plant	FT
Cypress, Piute	*Cupressus arizonica* ssp. *nevadensis*	CA	Plant	BS
Cypress, Santa Cruz	*Cupressus abramsiana*	CA	Plant	FE
Cypress, Tecate	*Callitropsis forbesii*	CA	Plant	BS
Dace, Amargosa speckled	*Rhinichthys osculus*	CA	Fish	BS
Dace, Ash Meadows speckled	*Rhinichthys osculus nevadensis*	NV	Fish	FE
Dace, Clover Valley speckled	*Rhinichthys osculus oligoporus*	NV	Fish	FE
Dace, desert	*Eremichthys acros*	NV	Fish	FT
Dace, Foskett speckled	*Rhinichthys osculus* ssp.	OR	Fish	FT
Dace, Independence Valley speckled	*Rhinichthys osculus lethoporus*	NV	Fish	FE
Dace, Kendall Warm Springs	*Rhinichthys osculus thermalis*	WY	Fish	FE
Dace, longfin	*Agosia chrysogaster*	AZ, NM	Fish	BS
Dace, Meadow Valley speckled	*Rhinichthys osculus*	NV	Fish	BS
Dace, millicoma	*Rhinichthys cataractae*	OR	Fish	BS
Dace, Moapa	*Moapa coriacea*	NV	Fish	FE
Dace, Moapa speckled	*Rhinichthys osculus moapae*	NV, OR	Fish	BS
Dace, Monitor Valley speckled	*Rhinichthys osculus* ssp.	NV	Fish	BS
Dace, northern redbelly x finescale	*Phoxinus eos* x *phoxinus neogaeus*	MT	Fish	BS
Dace, Oasis Valley speckled	*Rhinichthys osculus* ssp.	NV	Fish	BS
Dace, Owens speckled	*Rhinichthys osculus* ssp.	CA	Fish	BS
Dace, Pahranagat speckled	*Rhinichthys osculus velifer*	NV	Fish	BS
Dace, pearl	*Margariscus margarita*	MT	Fish	BS
Dace, relict	*Relictus solitarius*	NV	Fish	BS
Dace, speckled	*Rhinichthys osculus*	AZ, NM	Fish	BS
Dace, Umatilla	*Rhinichthys umatilla*	OR	Fish	BS
Dace, White River speckled	*Rhinichthys osculus* ssp.	NV	Fish	BS
Daisy, basalt	*Erigeron basalticus*	OR	Plant	BS
Daisy, Blochman's leafy	*Erigeron blochmaniae*	CA	Plant	BS
Daisy, Cedar Mountain Easter	*Townsendia microcephala*	WY	Plant	BS

Common Name	Scientific Name	State[1]	Class	Status[2]
Daisy, Engelmann's	*Erigeron engelmannii*	OR	Plant	BS
Daisy, hairy Townsend	*Townsendia strigosa*	CO	Plant	BS
Daisy, Hall's	*Erigeron aequifolius*	CA	Plant	BS
Daisy, Howell's	*Erigeron howellii*	OR	Plant	BS
Daisy, Kachina	*Erigeron kachinensis*	CO	Plant	BS
Daisy, Kern River	*Erigeron multiceps*	CA	Plant	BS
Daisy, Maguire	*Erigeron maguirei*	AZ, UT	Plant	FE
Daisy, Panamint	*Enceliopsis covillei*	CA	Plant	BS
Daisy, Parish's	*Erigeron parishii*	CA	Plant	FT
Daisy, Piper's	*Erigeron piperianus*	OR	Plant	BS
Daisy, rock (Laphamia, Hanaupah)	*Perityle villosa*	CA	Plant	BS
Daisy, Siskiyou	*Erigeron cervinus*	OR	Plant	BS
Daisy, Willamette	*Erigeron decumbens* var. *decumbens*	OR	Plant	FE
Dalea, ornate	*Dalea ornata*	CA, OR	Plant	BS
Dandelion, desert	*Malacothrix torreyi*	MT	Plant	BS
Dandelion, Rocky Mountain	*Taraxacum eriophorum*	MT	Plant	BS
Darter, Arkansas	*Etheostoma cragini*	CO	Fish	C
Darter, Iowa	*Etheostoma exile*	CO	Fish	BS
Darter, orangethroat	*Etheostoma spectabile*	MT	Fish	BS
Deer, Columbian white-tailed	*Odocoileus virginianus leucurus*	OR	Mammal	FE
Deer-fern	*Blechnum spicant*	ID, NM	Plant	BS
Desert sucker, Meadow Valley Wash	*Catostomus clarki*	NV	Fish	BS
Desertgrass, King's	*Blepharidachne kingii*	ID	Plant	BS
Desert-mallow, Rusby's	*Sphaeralcea rusbyi*	CA	Plant	BS
Desert-parsley, adobe	*Lomatium concinnum*	CO	Plant	BS
Desert-parsley, Bradshaw's	*Lomatium bradshawii*	OR	Plant	FE
Desert-parsley, Englemann's	*Lomatium engelmannii*	OR	Plant	BS
Desert-parsley, fringed	*Lomatium foeniculaceum*	OR	Plant	BS
Desert-parsley, Hoover's	*Lomatium tuberosum*	OR	Plant	BS
Desert-parsley, Nuttall	*Lomatium nuttallii*	MT	Plant	BS
Desert-parsley, Packard's	*Lomatium packardiae*	ID, NV	Plant	BS
Desert-parsley, Rollins'	*Lomatium rollinsii*	OR	Plant	BS
Desert-parsley, salmon-flower	*Lomatium salmoniflorum*	ID	Plant	BS
Desert-parsley, smooth	*Lomatium laevigatum*	OR	Plant	BS
Desert-parsley, Snake Canyon	*Lomatium serpentinum*	OR	Plant	BS
Desert-parsley, taper-tip	*Lomatium attenuatum*	MT	Plant	BS
Desert-parsley, Watson's desert	*Lomatium watsonii*	OR	Plant	BS
Dichanthelium, Geyser's	*Dichanthelium lanuginosum*	CA	Plant	BS
Dickcissel	*Spiza americana*	MT, UT	Bird	BS

Common Name	Scientific Name	State[1]	Class	Status[2]
Disc, Cockerell's striate	*Discus shemeki*	AZ, UT	Invertebrate	BS
Disc, marbled	*Discus marmorensis*	ID	Invertebrate	BS
Ditaxis, California	*Ditaxis californica*	CA	Invertebrate	BS
Dodder, sepal-tooth	*Cuscuta denticulata*	ID	Plant	BS
Dogweed, Wright's	*Adenophyllum wrightii*	NM	Plant	BS
Dogwood, Pacific	*Cornus nuttallii*	ID	Plant	BS
Doublet (dimeresia)	*Dimeresia howellii*	ID, UT	Plant	BS
Douglasia, Mackenzie River	*Douglasia arctica*	AK	Plant	BS
Downingia, Bacigalupi's	*Downingia bacigalupii*	ID	Plant	BS
Draba, beavertip	*Draba globosa*	MT	Plant	BS
Draba, Douglas'	*Cusickiella douglasii*	OR	Plant	BS
Draba, globe-fruited	*Draba globosa*	ID	Plant	BS
Draba, golden	*Draba aurea*	OR	Plant	BS
Draba, lance-leaved	*Draba cana*	OR	Plant	BS
Draba, long-stalked	*Draba longipes*	OR	Plant	BS
Draba, Mount Eddy	*Draba carnosula*	CA	Plant	BS
Draba, Ogilvlie Range	*Draba ogilviensis*	AK	Plant	BS
Draba, Wind River	*Draba ventosa*	MT	Plant	BS
Draba, Yellowstone	*Draba incerta*	ID	Plant	BS
Dropseed, annual	*Muhlenbergia minutissima*	OR	Plant	BS
Dropseed, tall	*Sporobolus asper*	ID	Plant	BS
Duck, canvasback	*Aythya valisineria*	MT	Bird	BS
Duck, fulvous whistling	*Dendrocygna bicolor*	AZ, ID	Bird	BS
Duck, harlequin	*Histrionicus histrionicus*	ID, MT, WY, OR	Bird	BS
Dudleya, Conejo	*Dudleya abramsii* ssp. *parva*	CA	Plant	FT
Dudleya, many-stemmed	*Dudleya multicaulis*	CA	Plant	BS
Dudleya, marcescent	*Dudleya cymosa* ssp. *marcescens*	CA	Plant	FT
Dudleya, panamint	*Dudleya saxosa*	CA	Plant	BS
Dudleya, San Luis Obispo	*Dudleya abramsii* ssp. *murina*	CA	Plant	BS
Dudleya, San Luis Obispo serpentine	*Dudleya abramsii* ssp. *bettinae*	CA, ID	Plant	BS
Dudleya, Santa Clara Valley	*Dudleya abramsii* ssp. *setchellii*	CA	Plant	FE
Dudleya, Santa Cruz Island	*Dudleya nesiotica*	CA	Plant	FT
Dudleya, variegated	*Dudleya variegata*	CA	Plant	BS
Dudleya, Verity's	*Dudleya verityi*	CA	Plant	FT
Dudleya, Santa Monica Mountains	*Dudleya cymosa*	CA	Plant	FT
Duskysnail, Columbia	*Colligyrus* sp.	OR	Invertebrate	BS
Dwarf-flax, Marin	*Hesperolinon congestum*	CA	Plant	FT

Common Name	Scientific Name	State[1]	Class	Status[2]
Eagle, bald	*Haliaeetus leucocephalus*	AK, AZ, CA, CO, ID, MT, NM, NV, OR, UT, WY	Bird	BS
Eagle, golden	*Aquila chrysaetos*	AK, AZ, CA, MT, NV, UT, WY	Bird	BS
Earthworm, Oregon giant	*Driloleirus macfreshi*	OR	Invertebrate	BS
Eater, truffle	*Cordyceps ophioglossoides*	CA	Plant	BS
Eatonella, white	*Eatonella nivea*	ID, OR	Plant	BS
Egret, snowy	*Egretta thula*	OR	Bird	BS
Eider, spectacled	*Somateria fischeri*	AK	Bird	FT
Eider, Steller's	*Polysticta stelleri*	AK	Bird	FT
Elfin, hoary	*Callophrys polios*	OR	Invertebrate	BS
Entoloma, indigo	*Entoloma nitidum*	CA	Plant	BS
Eriastrum, Brandegee's	*Eriastrum brandegeae*	CA	Plant	BS
Eriastrum, Harwood's	*Eriastrum harwoodii*	CA	Plant	BS
Eriastrum, Tracy's	*Eriastrum tracyi*	CA	Plant	BS
Eriastrum, yellow-flowered	*Eriastrum luteum*	CA	Plant	BS
Erigeron, white cushion	*Erigeron disparipilus*	OR	Plant	BS
Erigeron, Yukon	*Erigeron yukonensis*	AK	Plant	BS
Eriogonum, short-flowered	*Eriogonum brachyanthum*	OR	Plant	BS
Eulachon, Pacific	*Thaleichthys pacificus*	OR	Fish	FT
Evax, short-leaved	*Hesperevax sparsiflora*	CA	Plant	BS
Evening-primrose, Antioch Dunes	*Oenothera deltoides*	CA	Plant	FE
Evening-primrose, dwarf	*Camissonia pygmaea*	OR	Plant	BS
Evening-primrose, Eureka Valley	*Oenothera avita*	CA	Plant	FE
Evening-primrose, Hardham's	*Camissonia hardhamiae*	CA	Plant	BS
Evening-primrose, Kern River	*Camissonia integrifolia*	CA	Plant	BS
Evening-primrose, naked-stemmed	*Camissonia scapoidea*	OR	Plant	BS
Evening-primrose, narrowleaf	*Oenothera acutissima*	CO	Plant	BS
Evening-primrose, obscure	*Camissonia andina*	MT	Plant	BS
Evening-primrose, Organ Mountain	*Oenothera organensis*	NM	Plant	BS
Evening-primrose, pale	*Oenothera pallida*	MT	Plant	BS
Evening-primrose, Palmer's	*Camissonia palmeri*	ID	Plant	BS
Evening-primrose, Saint Anthony	*Oenothera psammophila*	ID	Plant	BS
Evening-primrose, San Benito	*Camissonia benitensis*	CA	Plant	FT
Evening-primrose, slender	*Camissonia exilis*	AZ, OR	Plant	BS

Common Name	Scientific Name	State[1]	Class	Status[2]
Evening-primrose, slender-flowered	*Camissonia graciliflora*	OR	Plant	BS
Evening-primrose, tufted	*Oenothera caespitosa*	OR	Plant	BS
Evening-primrose, winged-seed	*Camissonia pterosperma*	ID	Plant	BS
Evening-primrose, Wolf's	*Oenothera wolfii*	CA, OR	Plant	BS
Eyed-grass, strict blue	*Sisyrinchium montanum*	OR	Plant	BS
Fairy fan	*Spathularia flavida*	CA	Plant	BS
Fairy shrimp, conservancy	*Branchinecta conservatio*	CA	Invertebrate	FE
Fairy shrimp, longhorn	*Branchinecta longiantenna*	CA	Invertebrate	FE
Fairy shrimp, riverside	*Streptocephalus woottoni*	CA	Invertebrate	FE
Fairy shrimp, San Diego	*Branchinecta sandiegonensis*	CA	Invertebrate	FE
Fairy shrimp, vernal pool	*Branchinecta lynchi*	CA, OR	Invertebrate	FT
Fairypoppy, white	*Meconella oregana*	OR	Plant	BS
Falcon, American peregrine	*Falco peregrinus anatus*	AZ, CO, OR	Bird	BS
Falcon, arctic peregrine	*Falco peregrinus tundrius*	OR	Bird	BS
Falcon, northern aplomado	*Falco femoralis* ssp. *Septentrionalis*	AZ, NM	Bird	FE/XN
Falcon, Peale's peregrine	*Falco peregrinus*	OR	Bird	BS
Falcon, peregrine	*Falco peregrinus*	ID, MT, NM, NV, WY	Bird	BS
Falcon, prairie	*Falco mexicanus*	ID	Bird	BS
False yarrow, Cusick's	*Chaenactis cusickii*	AZ, ID	Plant	BS
False-oats, Siberian	*Trisetum sibiricum*	AK	Plant	BS
Fameflower, spinescent	*Talinum spinescens*	OR	Plant	BS
Fawn-lily, Coast Range	*Erythronium elegans*	OR	Plant	BS
Fawn-lily, Howell's	*Erythronium howellii*	OR	Plant	BS
Fawn-lily, Scott Mountain	*Erythronium citrinum*	CA	Plant	BS
Fawn-lily, Tuolumne	*Erythronium tuolumnense*	CA	Plant	BS
Feathergrass, Porter	*Ptilagrostis porteri*	CO	Plant	BS
Felwort, marsh	*Lomatogonium rotatum*	ID, MT	Plant	BS
Fern, Aleutian shield	*Polystichum aleuticum*	AK	Plant	FE
Fern, bird's-foot	*Pellaea mucronata*	OR	Plant	BS
Fern, coffee	*Pellaea andromedifolia*	OR	Plant	BS
Fern, goldenback	*Pentagramma triangularis*	ID	Plant	BS
Ferret, black-footed	*Mustela nigripes*	AZ, CO, MT, UT, WY	Mammal	FE/XN
Feverfew, Colorado	*Parthenium ligulatum*	CO, NV	Plant	BS
Fiddleleaf, matted	*Nama densum* var. *parviflorum*	CO	Plant	BS
Fiddleneck, bent-flowered	*Amsinckia lunaris*	CA	Plant	BS
Fiddleneck, large-flowered	*Amsinckia grandiflora*	CA	Plant	FE
Fiddleneck, Malheur Valley	*Amsinckia carinata*	OR	Plant	BS
Fieldslug, evening	*Deroceras hesperium*	OR	Invertebrate	BS

Common Name	Scientific Name	State[1]	Class	Status[2]
Figwort, black-flowered	*Scrophularia atrata*	CA	Plant	BS
Figwort, Organ Mountain	*Scrophularia laevis*	NM	Plant	BS
Filaree, round-leaved	*California macrophylla*	CA	Plant	BS
Fireweed, Oregon	*Epilobium oreganum*	CA, OR	Plant	BS
Fireweed, Siskiyou	*Epilobium siskiyouense*	CA	Plant	BS
Fisher	*Martes pennanti*	CA, MT, OR	Mammal	C
Fishhook cactus, Great Basin	*Sclerocactus pubispinus*	NV	Plant	BS
Fishhook cactus, Paria Plateau	*Sclerocactus sileri*	AZ	Plant	BS
Fishhook cactus, Wright	*Sclerocactus wrightiae*	UT	Plant	FE
Flameflower, Pinos Altos	*Talinum humile*	NM	Plant	BS
Flannelbush, California	*Fremontodendron californica*	AZ, CA	Plant	BS
Flannelbush, Mexican	*Fremontodendron mexicanum*	CA	Plant	FE
Flannelbush, Pine Hill	*Fremontodendron californicum* ssp. *decumbens*	CA	Plant	FE
Flatsedge, Great Plains	*Cyperus lupulinus* ssp. *lupulinus*	OR	Plant	BS
Flatsedge, Schweinitz	*Cyperus schweinitzii*	MT	Plant	BS
Flatworm	*Kenkia rhynchida*	OR	Invertebrate	BS
Flax, Brewer's dwarf	*Hesperolinon breweri*	CA	Plant	BS
Flax, drymaria-like western	*Hesperolinon drymarioides*	CA	Plant	BS
Flax, glandular western	*Hesperolinon adenophyllum*	CA	Plant	BS
Flax, Lake County dwarf	*Hesperolinon didymocarpum*	CA	Plant	BS
Flax, Napa western	*Hesperolinon serpentinum*	CA	Plant	BS
Flax, Tehama County western	*Hesperolinon tehamense*	CA	Plant	BS
Fleabane, broad	*Erigeron latus*	NV, OR	Plant	BS
Fleabane, buff	*Erigeron ochroleucus*	MT	Plant	BS
Fleabane, Fish Creek	*Erigeron piscaticus*	AZ	Plant	BS
Fleabane, gorge	*Erigeron oreganus*	OR	Plant	BS
Fleabane, Idaho	*Erigeron asperugineus*	MT	Plant	BS
Fleabane, Lemmon	*Erigeron lemmonii*	AZ	Plant	C
Fleabane, linearleaf	*Erigeron linearis*	MT	Plant	BS
Fleabane, Muir's	*Erigeron muirii*	AK	Plant	BS
Fleabane, Salish	*Erigeron salishii*	OR	Plant	BS
Fleabane, sheep	*Erigeron ovinus*	CA, NV	Plant	BS
Fleabane, Zuni	*Erigeron rhizomatus*	AZ, NM	Plant	FT
Fleece, golden	*Ericameria arborescens*	OR	Plant	BS
Flicker, gilded	*Colaptes chrysoides*	AZ, CA	Bird	BS
Floater, California	*Anodonta californiensis*	ID, NV	Invertegrate	BS
Fly, Delhi Sands flower-loving	*Rhaphiomidas terminatus*	CA	Invertebrate	FE
Flycatcher, ash-throated	*Myiarchus cinerascens*	OR	Bird	BS
Flycatcher, cordilleran	*Empidonax occidentalis*	ID	Bird	BS
Flycatcher, dusky	*Empidonax oberholseri*	ID	Bird	BS

Common Name	Scientific Name	State[1]	Class	Status[2]
Flycatcher, gray	*Empidonax wrightii*	CA, OR	Bird	BS
Flycatcher, Hammond's	*Empidonax hammondii*	ID, OR	Bird	BS
Flycatcher, olive-sided	*Contopus borealis*	AK, ID, NM, OR, WY	Bird	BS
Flycatcher, southwestern willow	*Empidonax traillii extimus*	AZ, CA, CO, NM, NV, UT	Bird	FE
Flycatcher, willow	*Empidonax traillii*	ID	Bird	BS
Forget-me-not, pale alpine	*Eritrichium nanum*	OR	Plant	BS
Four-o' clock, Macfarlane's	*Mirabilis macfarlanei*	ID, OR	Plant	FT
Fox, kit	*Vulpes velox macrotis*	CO, ID, OR, UT	Mammal	BS
Fox, San Joaquin kit	*Vulpes macrotis mutica*	CA	Mammal	FE
Fox, San Miguel Island	*Urocyon littoralis littoralis*	CA	Mammal	FE
Fox, Santa Catalina Island	*Urocyon littoralis catalinae*	CA	Mammal	FE
Fox, Santa Cruz Island	*Urocyon littoralis santacruzae*	CA	Mammal	FE
Fox, Santa Rosa Island	*Urocyon littoralis santarosae*	CA	Mammal	FE
Fox, swift	*Vulpes velox*	CO, MT, WY	Mammal	BS
Foxtail cactus, Alverson's	*Coryphantha vivpara* var. *alversonii* (=*Escobaria vivipara)*	CA	Plant	BS
Frasera, tufted	*Frasera paniculata*	CO	Plant	BS
Fringepod, Santa Cruz Island	*Thysanocarpus conchuliferus*	CA	Plant	FE
Fritillary, butte	*Fritillaria eastwoodiae*	CA	Invertebrate	BS
Fritillary, coronis	*Speyeria coronis*	OR	Invertebrate	BS
Fritillary, Gentner's	*Fritillaria gentneri*	CA, OR	Plant	FE
Fritillary, Great Basin	*Speyeria egleis*	OR	Invertebrate	BS
Fritillary, meadow	*Boloria bellona*	OR	Invertebrate	BS
Fritillary, Ojai	*Fritillaria ojaiensis*	CA	Plant	BS
Fritillary, San Benito	*Fritillaria viridea*	CA	Plant	BS
Fritillary, silver-bordered	*Boloria selene*	OR	Invertebrate	BS
Fritillary, talus	*Fritillaria falcata*	CA	Plant	BS
Frog, California red-legged	*Rana draytonii*	CA	Amphibian	FT
Frog, Chiricahua leopard	*Rana chiricahuensis*	AZ, NM	Amphibian	FT
Frog, Columbia spotted	*Rana luteiventris*	ID, MT, NV, OR, UT, WY	Amphibian	C
Frog, foothill yellow-legged	*Rana boylei*	CA, OR	Amphibian	BS
Frog, inland tailed	*Ascaphus montanus*	OR	Amphibian	BS
Frog, lowland leopard	*Lithobates yavapaiensis*	AZ, CA	Amphibian	BS
Frog, mountain yellow-legged	*Rana muscosa*	CA, NV	Amphibian	FE
Frog, northern cricket	*Acris crepitans*	CA, CO, NM, UT	Amphibian	BS

Common Name	Scientific Name	State[1]	Class	Status[2]
Frog, northern leopard	*Rana pipiens*	AZ, CO, ID, MT, NV, OR, WY	Amphibian	BS
Frog, Oregon spotted	*Rana pretiosa*	CA, OR	Amphibian	FT
Frog, plains leopard	*Rana blairi*	AZ, CO	Amphibian	BS
Frog, relict leopard	*Lithobates onca*	AZ, NV	Amphibian	C
Frog, San Sebastian leopard	*Rana yavapaiensis*	CA, NM, UT	Amphibian	BS
Frog, Sierra Nevada yellow-legged	*Rana sierrae*	CA	Amphibian	FE
Frog, tailed	*Ascaphus truei*	MT	Amphibian	BS
Frog, wood	*Rana syvatica*	MT	Amphibian	BS
Fumewort, cold-water	*Corydalis aquae-gelidae*	OR	Plant	BS
Fungi	*Albatrellus avellaneus*	OR	Fungi	BS
Fungi	*Alpova alexsmithii*	OR	Fungi	BS
Fungi	*Arcangeliella camphorata*	OR	Fungi	BS
Fungi	*Boletus pulcherrimus*	OR	Fungi	BS
Fungi	*Bridgeoporus nobilissimus*	OR	Fungi	BS
Fungi	*Chamonixia caespitosa*	OR	Plant	BS
Fungi	*Cortinarius barlowensis*	OR	Fungi	BS
Fungi	*Cudonia monticola*	OR	Fungi	BS
Fungi	*Cystangium idahoensis*	OR	Fungi	BS
Fungi	*Destuntzia rubra*	OR	Fungi	BS
Fungi	*Gastroboletus imbellus*	OR	Fungi	BS
Fungi	*Gastroboletus vividus*	OR	Fungi	BS
Fungi	*Gomphus kauffmanii*	OR	Fungi	BS
Fungi	*Gymnomyces fragrans*	OR	Fungi	BS
Fungi	*Gymnomyces nondistincta*	OR	Fungi	BS
Fungi	*Helvella crassitunicata*	OR	Fungi	BS
Fungi	*Mythicomyces corneipes*	OR	Fungi	BS
Fungi	*Octaviania macrospora*	OR	Fungi	BS
Fungi	*Otidea smithii*	OR	Fungi	BS
Fungi	*Phaeocollybia dissiliens*	OR	Fungi	BS
Fungi	*Phaeocollybia gregaria*	OR	Fungi	BS
Fungi	*Phaeocollybia oregonensis*	OR	Fungi	BS
Fungi	*Phaeocollybia pseudofestiva*	CA, OR	Fungi	BS
Fungi	*Phaeocollybia scatesiae*	CA, OR	Fungi	BS
Fungi	*Phaeocollybia sipei*	OR	Fungi	BS
Fungi	*Phaeocollybia spadicea*	CA, OR	Fungi	BS
Fungi	*Pseudorhizina californica*	OR	Fungi	BS
Fungi	*Ramaria gelatiniaurantia*	OR	Fungi	BS
Fungi	*Ramaria rubella*	OR	Fungi	BS
Fungi	*Ramaria spinulosa*	OR	Fungi	BS
Fungi	*Rhizopogon chamaleontinus*	OR	Fungi	BS

Common Name	Scientific Name	State[1]	Class	Status[2]
Fungi	*Rhizopogon ellipsosporus*	OR	Fungi	BS
Fungi	*Rhizopogon exiguus*	OR	Fungi	BS
Fungi	*Rhizopogon inquinatus*	OR	Fungi	BS
Fungi	*Stagnicola perplexa*	OR	Fungi	BS
Fungi	*Thaxterogaster pavelekii*	OR	Fungi	BS
Fungus, stalked orange peel	*Sowerbyella rhenana*	CA, OR	Fungi	BS
Fuzzwort, pacific	*Ptilidium californicum*	CA	Plant	BS
Gambusia, Pecos	*Gambusia nobilis*	NM	Fish	FE
Gar, shortnose	*Lepisosteus platostomus*	MT	Fish	BS
Gecko, barefoot banded	*Coleonyx switaki*	CA	Reptile	BS
Gecko, Utah banded	*Coleonyx variegates*	UT	Reptile	BS
Gecko, western banded	*Coleonyx variegatus*	UT	Reptile	BS
Gentian, Cathedral Bluff dwarf	*Gentianella tortuosa*	CO	Plant	BS
Gentian, elegant	*Gentiana plurisetosa*	OR	Plant	BS
Gentian, glaucous	*Gentiana glauca*	OR	Plant	BS
Gentian, hiker's	*Gentianopsis simplex*	MT	Plant	BS
Gentian, Mendocino	*Gentiana setigera*	CA, OR	Plant	BS
Gentian, moss	*Gentiana prostrata*	OR	Plant	BS
Gentian, Newberry's	*Gentiana newberryi*	OR	Plant	BS
Gentian, sheared	*Gentianopsis detonsa*	AK	Plant	BS
Gentian, slender	*Gentianella tenella*	OR	Plant	BS
Gentian, Sunnyside green	*Frasera gypsicola*	NV	Plant	BS
Gentian, swamp	*Gentiana douglasiana*	OR	Plant	BS
Gila monster, banded	*Heloderma suspectum*	AZ, NV, UT	Reptile	BS
Gilia, Aztec	*Gilia formosa*	NM	Plant	BS
Gilia, dark-eyed	*Gilia millefoliata*	CA, CO, OR	Plant	BS
Gilia, Hoffmann's slender-flowered	*Gilia tenuiflora* ssp. *hoffmannii*	CA	Plant	FE
Gilia, Little San Bernardino Mtns.	*Linanthus maculatus*	CA	Plant	BS
Gilia, Monterey	*Gilia tenuiflora* ssp. *arenaria*	CA	Plant	FE
Gilia, narrow-stem	*Gilia stenothyrsa*	CO	Plant	BS
Gilia, Rabbit Valley	*Gilia caespitosa*	UT	Plant	C
Gilia, sand	*Gilia tenuiflora*	CO, CA, NM	Plant	FE
Gilia, spreading	*Ipomopsis polycladon*	ID	Plant	BS
Glasswort, red	*Salicornia rubra*	ID	Plant	BS
Globeberry, Texas	*Ibervillea tenuisecta*	AZ	Plant	BS
Globeberry, Tumamoc	*Tumamoca macdougalii*	AZ	Plant	BS
Globeflower, American	*Trollius laxus*	OR	Plant	BS
Globemallow, Baker's	*Iliamna bakeri*	OR	Plant	BS
Globemallow, California	*Iliamna latibracteata*	OR	Plant	BS
Globemallow, longsepal	*Iliamna longisepala*	OR	Plant	BS

Common Name	Scientific Name	State[1]	Class	Status[2]
Globemallow, Railroad Valley	*Sphaeralcea caesoutisa*	NV	Plant	BS
Globemallow, white-stemmed	*Sphaeralcea munroana*	MT	Plant	BS
Glossopetalon, pungent	*Glossopetalon pungens*	CA	Plant	BS
Gnatcatcher, blue-gray	*Polioptila caerulea*	MT	Bird	BS
Gnatcatcher, coastal California	*Polioptila californica californica*	CA	Bird	FT
Goat, mountain	*Oreamnos americanus*	OR	Mammal	BS
Goatsfoot, greening	*Albatrellus ellisii*	CA	Fungi	BS
Goby, tidewater	*Eucyclogobius newberryi*	CA	Fish	FE
Godwit, marbled	*Limosa fedoa*	MT	Bird	BS
Gold, July	*Dedeckera eurekensis*	CA	Plant	BS
Goldenaster, Oregon	*Heterotheca oregona*	OR	Plant	BS
Goldenaster, Shevock's hairy	*Heterotheca shevockii*	CA	Plant	BS
Goldenbush, Antelope Canyon	*Ericameria cervina*	NV	Plant	BS
Goldenbush, Eastwood's	*Ericameria fasciculata*	CA	Plant	BS
Goldenbush, Gilman's	*Ericameria gilmanii*	CA	Plant	BS
Goldenbush, Palmer's	*Ericameria palmeri*	CA	Plant	BS
Goldenbush, whitestem	*Ericameria discoidea*	WY	Plant	BS
Golden-carpet, northern	*Chrysosplenium tetrandrum*	OR	Plant	BS
Goldeneye, Barrow's	*Bucephala islandica*	CO, ID	Bird	BS
Goldeneye, showy	*Heliomeris multiflora*	MT	Plant	BS
Goldenhead, Lone Mountain	*Tonestus graniticus*	NV	Plant	BS
Goldenrod, few-flowered	*Solidago velutina*	MT	Plant	BS
Goldenstar, San Diego	*Muilla clevelandii*	CA	Plant	BS
Goldenweed, beartooth large-flowered	*Pyrrocoma carthamoides*	MT	Plant	BS
Goldenweed, bugleg	*Pyrrocoma insecticruris*	ID, OR	Plant	BS
Goldenweed, Palouse	*Pyrrocoma liatriformis*	ID, OR	Plant	BS
Goldenweed, Snake River	*Pyrrocoma radiata*	ID, OR	Plant	BS
Goldenweed, sticky	*Pyrrocoma hirta*	ID, OR	Plant	BS
Goldfields, Burke's	*Lasthenia burkei*	CA	Plant	FE
Goldfields, Contra Costa	*Lasthenia conjugens*	CA, UT	Plant	FE
Goldfields, Coulter's	*Lasthenia glabrata*	CA	Plant	BS
Goldfields, large-flowered	*Lasthenia orndufii*	OR	Plant	BS
Goldfields, smooth	*Lasthenia glaberrima*	OR	Plant	BS
Goldfinch, lesser	*Carduelis psaltria*	OR	Bird	BS
Goldflower, Cooper's	*Hymenoxys lemmonii*	OR	Plant	BS
Goldthread, spleenwort-leaved	*Coptis aspleniifolia*	OR	Plant	BS
Goldthread, three-leaf	*Coptis trifolia*	OR	Plant	BS
Goose, Aleutian Canada	*Branta canadensis leucopareia*	CA, OR	Bird	BS
Goose, dusky Canada	*Branta canadensis*	AK, OR	Bird	BS

Common Name	Scientific Name	State[1]	Class	Status[2]
Goose, emperor	*Chen canagica*	AK	Bird	BS
Gooseberry, Idaho	*Ribes oxyacanthoides*	OR	Plant	BS
Gooseberry, Sequoia	*Ribes tularense*	CA	Plant	BS
Gooseberry, straggly	*Ribes divaricatum*	OR	Plant	BS
Gopher, desert pocket	*Geomys bursarius*	NM	Mammal	BS
Gopher, fish spring pocket	*Thomomys umbrinus abstrusus*	NV	Mammal	BS
Gopher, Guadalupe Southern pocket	*Thomomys umbrinus guadalupensis*	NM	Mammal	BS
Gopher, Idaho pocket	*Thomomys idahoensis*	WY	Mammal	BS
Gopher, San Antonio pocket	*Thomomys umbrinus curtatus*	NV	Mammal	BS
Gopher, southern pocket	*Thomomys umbrinus* ssp.	NM	Mammal	BS
Gopher, western pocket	*Thomomys mazama* ssp.	OR	Mammal	BS
Gopher, Wyoming pocket	*Thomomys clusius*	WY	Mammal	BS
Goshawk, northern	*Accipiter gentilis*	AZ, CA, CO, ID, MT, NV, OR, UT, WY	Bird	BS
Gramma, blue	*Bouteloua gracilis*	ID	Plant	BS
Grape-fern, lance-leaved	*Botrychium lanceolatum*	ID	Plant	BS
Grape-fern, mountain	*Botrychium montanum*	OR	Plant	BS
Grape-fern, pumice	*Botrychium pumicola*	OR	Plant	BS
Grappling hook, Palmer's	*Harpagonella palmeri*	CA	Plant	BS
Grass	Poaceae	CA	Plant	BS
Grass bug, american acetropis	*Acetropis americana*	OR	Invertebrate	BS
Grass, Blasdale's bent	*Agrostis blasdalei*	CA	Plant	BS
Grass, blue-eyed	*Sisyrinchium septentrionale*	OR	Plant	BS
Grass, Colusa	*Neostapfia colusana*	CA	Plant	FT
Grass, Diablo Canyon blue	*Poa diaboli*	CA	Plant	BS
Grass, Eureka Dune	*Swallenia alexandrae*	CA	Plant	FE
Grass, Hitchcock's blue-eyed	*Sisyrinchium hitchcockii*	OR	Plant	BS
Grass, Hoover's bent	*Agrostis hooveri*	CA	Plant	BS
Grass, Hoover's semaphore	*Pleuropogon hooverianus*	CA	Plant	BS
Grass, Scribner's	*Scribneria bolanderi*	OR	Plant	BS
Grass, Scribner's panic	*Dichanthelium oligosanthes*	MT	Plant	BS
Grass, Solano	*Tuctoria mucronata*	CA	Plant	FE
Grass-fern	*Asplenium septentrionale*	OR	Plant	BS
Grasshopper, Idaho pointheaded	*Acrolophitus punchellus*	ID	Invertebrate	BS
Grasshopper, Siskiyou short-horned	*Chloealtis aspasma*	OR	Invertebrate	BS
Grasshopper, Zayante band-winged	*Trimerotropis infantilis*	CA	Invertebrate	FE
Grass-of-parnassus, Kotzebue's	*Parnassia kotzebuei*	OR	Plant	BS
Grass-of-parnassus, northern	*Parnassia palustris*	OR	Plant	BS

Common Name	Scientific Name	State[1]	Class	Status[2]
Grayling, arctic	*Thymallus arcticus*	MT	Fish	C
Greasebush, rough dwarf	*Glossopetalon pungens* var. *pungens*	NV	Plant	BS
Greasebush, smooth dwarf	*Glossopetalon pungens* var. *glabrum*	NV	Plant	BS
Grebe, Clark's	*Aechmophorus clarkii*	OR	Bird	BS
Grebe, eared	*Podiceps nigricollis*	OR	Bird	BS
Grebe, horned	*Podiceps auritus*	OR	Bird	BS
Grebe, red-necked	*Podiceps grisegena*	ID, OR	Bird	BS
Greenbriar, English Peak	*Smilax jamesii*	CA	Plant	BS
Greenthread, Green River	*Thelesperma caespitosum*	WY	Plant	BS
Greenthread, Uinta	*Thelesperma pubescens*	CA, NM, WY	Plant	BS
Grosbeak, blue	*Guiraca caerulea*	UT	Bird	BS
Groundsel, San Francisco Peaks	*Senecio franciscanus*	AZ	Plant	FT
Groundstar, Santa Ynez	*Ancistrocarphus keilii*	CA	Plant	BS
Grouse, Columbian sharp-tailed	*Tympanuchus phasianellus*	CA, CO, ID, MT, OR, UT, WY	Bird	BS
Gull, Franklin's	*Larus pipixcan*	MT, OR	Bird	BS
Gumplant, Ash Meadows	*Grindelia fraxino-pratensis*	CA, ID, NV	Plant	FT
Gumweed, Howell's	*Grindelia howellii*	ID, MT	Plant	BS
Gymnopilus, blue-green	*Gymnopilus punctifolius*	CA	Plant	BS
Gyrfalcon	*Falco rusticolus*	OR	Bird	BS
Hairstreak, Barry's	*Callophrys gryneus*	OR	Invertebrate	BS
Hairstreak, Johnson's	*Callophrys johnsoni*	OR	Invertebrate	BS
Halimolobos, puzzling	*Halimolobos perplexa*	ID	Invertebrate	BS
Hare, Alaskan	*Lepus othus*	AK	Mammal	BS
Harebell, Alaska	*Campanula lasiocarpa*	OR	Plant	BS
Harebell, Castle Crags	*Campanula shetleri*	CA	Plant	BS
Harebell, chaparral	*Campanula exigua*	CA	Plant	BS
Harebell, Sharsmith's	*Campanula sharsmithiae*	CA	Plant	BS
Harebell, swamp	*Campanula californica*	CA	Plant	BS
Harmonia, Hall's	*Harmonia hallii*	CA	Plant	BS
Harmonia, Nile's	*Harmonia doris-nilesiae*	CA	Plant	BS
Harrier, northern	*Circus cyaneus*	ID, OR	Bird	BS
Hawk, ferruginous	*Buteo regalis*	AZ, CO, ID, MT, NV, NM, OR, UT, WY	Bird	BS
Hawk, northern gray	*Buteo nitidus*	AZ, ID, MT, WY	Bird	BS
Hawk, Swainson's	*Buteo swainsoni*	CA, MT, NV, UT	Bird	BS
Hawksbeard, Idaho	*Crepis bakeri*	ID	Plant	BS

Common Name	Scientific Name	State[1]	Class	Status[2]
Hawkweed, shaggy	*Hieracium horridum*	OR	Plant	BS
Hazardia, Orcutt's	*Hazardia orcuttii*	CA	Plant	C
Hearts, three	*Tricardia watsonii*	ID	Plant	BS
Hedgehog cactus, Arizona	*Echinocereus triglochidiatus* var. *arizonicus*	AZ	Plant	FE
Hedgehog cactus, Howe's	*Echinocereus engelmannii*	CA	Plant	BS
Hedgehog cactus, Kuenzler's	*Echinocereus fendleri* var. *kuenzleri*	NM	Plant	FE
Hedgehog cactus, Simpson's	*Pediocactus simpsonii*	ID	Plant	BS
Hedgehog, violet	*Sarcodon fuscoindicus*	CA	Fungi	BS
Hedge-hyssop, Boggs Lake	*Gratiola heterosepala*	CA, OR	Plant	BS
Heliotrope, salt	*Heliotropium curassavicum*	OR	Plant	BS
Helodium, Blandow's	*Helodium blandowii*	ID, OR	Plant	BS
Hendersons, ricegrass	*Achnatherum hendersonii*	OR	Plant	BS
Heron, black-crowned night	*Nycticorax nycticorax*	MT	Bird	BS
Hesperian (snail), Sisters	*Hochbergellus hirsutus*	OR	Invertebrate	BS
Hesperian, Siskiyou	*Vespericola sierranus*	OR	Invertebrate	BS
Hookless cactus, Uinta Basin	*Sclerocactus wetlandicus*	UT	Plant	FT
Hopsage, spiny	*Grayia spinosa*	MT	Plant	BS
Horkelia, Henderson's	*Horkelia hendersonii*	CA	Plant	BS
Horkelia, Parry's	*Horkelia parryi*	CA	Plant	BS
Horkelia, shaggy	*Horkelia congesta*	AZ, OR	Plant	BS
Horkelia, thin-lobed	*Horkelia tenuiloba*	CA	Plant	BS
Horkelia, three-toothed	*Horkelia tridentata*	OR	Plant	BS
Hornshell, Texas	*Popenaias popei*	NM	Invertebrate	C
Horsehair, yellow-twist	*Bryoria tortuosa*	CA	Plant	BS
Horse-mint, Cusick's	*Agastache cusickii*	MT, OR	Plant	BS
Horse-nettle, Parish's	*Solanum parishii*	OR	Plant	BS
Howellia, water	*Howellia aquatilis*	CA, ID, MT, OR	Plant	FT
Hulsea, Inyo	*Hulsea vestita*	CA	Plant	BS
Hummingbird, Calliope	*Stellula calliope*	ID	Bird	BS
Hummingbird, rufous	*Selaphorus rufus*	ID	Bird	BS
Hutchensia, prostrate	*Hutchinsia procumbens*	MT	Plant	BS
Ibis, white-faced	*Plegadis chihi*	AZ, CO, MT, WY	Bird	BS
Iguana, desert	*Dipsosaurus dorsalis*	UT	Reptile	BS
Indian paintbrush, San Clemente Island	*Castilleja grisea*	CA	Plant	FE
Ipomopsis, ballhead	*Ipomopsis congesta*	MT	Plant	BS
Ipomopsis, Holy Ghost	*Ipomopsis sancti-spiritus*	NM	Plant	FE
Iris, Gorman's	*Iris tenax*	OR	Plant	BS
Iris, Munz's	*Iris munzii*	CA	Plant	BS

Common Name	Scientific Name	State[1]	Class	Status[2]
Isopod, socorro	*Thermosphaeroma thermophilus*	NM	Invertebrate	FE
Ivesia, alkali	*Ivesia kingii* var. *kingii*	CA, NV	Plant	BS
Ivesia, Ash Creek	*Ivesia paniculata*	CA, OR	Plant	BS
Ivesia, Ash Meadows	*Ivesia kingii* var. *eremica*	CA, NV	Plant	FT
Ivesia, Castle Crags	*Ivesia longibracteata*	CA	Plant	BS
Ivesia, grimy	*Ivesia rhypara* ssp. *rhypara*	NV, OR	Plant	BS
Ivesia, Jaeger's	*Ivesia jaegeri*	CA, NV	Plant	BS
Ivesia, Kingston Mountains	*Ivesia patellifera*	CA	Plant	BS
Ivesia, Pickering's	*Ivesia pickeringii*	CA	Plant	BS
Ivesia, Pine Nut Mountains	*Ivesia pityocharis*	NV	Plant	BS
Ivesia, Plumas	*Ivesia sericoleuca*	CA	Plant	BS
Ivesia, Shelly's	*Ivesia rhypara* ssp. *shellyi*	OR	Plant	BS
Ivesia, Shockley's	*Ivesia shockleyi*	OR	Plant	BS
Ivesia, Webber	*Ivesia webberi*	CA, NV	Plant	FT
Jackrabbit, black-tailed	*Lepus californicus*	OR	Mammal	BS
Jackrabbit, white-tailed	*Lepus townsendii*	OR	Mammal	BS
Jaguar	*Panthera onca*	AZ, NM	Mammal	FE
Jaguarundi	*Puma yaguarondi*	AZ	Mammal	FE
Jay, pinyon	*Gymnorhinus cyanocephalus*	AZ, NV	Bird	BS
Jewelflower, California	*Caulanthus californicus*	CA	Plant	FE
Jewelflower, common	*Streptanthus glandulosus*	OR	Plant	BS
Jewelflower, Dorr's Cabin	*Streptanthus morrisonii* ssp. *hirtiflorus*	CA	Plant	BS
Jewelflower, early	*Streptanthus vernalis*	CA	Plant	BS
Jewelflower, Freed's	*Streptanthus brachiatus*	CA	Plant	BS
Jewelflower, Hoffman's	*Streptanthus glandulosus* var. *hoffmanii*	CA	Plant	BS
Jewelflower, Kruckeberg's	*Streptanthus morrisonii* ssp. *kruckebergii*	CA	Plant	BS
Jewelflower, Lemmon's	*Caulanthus coulteri*	CA	Plant	BS
Jewelflower, Masonic Mountain	*Streptanthus oliganthus*	CA, NV	Plant	BS
Jewelflower, Metcalf Canyon	*Streptanthus albidus* ssp. *albidus*	CA	Plant	FE
Jewelflower, Morrison's	*Streptanthus morrisonii* ssp. *morrisonii*	CA	Plant	BS
Jewelflower, Mount Hamilton	*Streptanthus callistus*	CA	Plant	BS
Jewelflower, Piute Mountains	*Streptanthus cordatus*	CA	Plant	BS
Jewelflower, Santa Barbara	*Caulanthus amplexicaulis*	CA	Plant	BS
Jewelflower, Socrates Mine	*Streptanthus brachiatus*	CA	Plant	BS
Jewelflower, Three Peaks	*Streptanthus morrisonii* ssp. *elatus*	CA	Plant	BS
Jewelflower, Tiburon	*Streptanthus niger*	CA	Plant	FE

Common Name	Scientific Name	State[1]	Class	Status[2]
Juga (snail), barren	*Juga hemphilli hemphilli*	OR	Invertebrate	BS
Juga (snail), bulb	*Juga bulbosa*	OR	Invertebrate	BS
Juga (snail), Dalles	*Juga hemphilli dallesensis*	OR	Invertebrate	BS
Juga (snail), opal springs	*Juga* sp.	OR	Invertebrate	BS
Juga, purple-lipped (Deschutes)	*Juga hemphilli maupinensis*	OR	Invertebrate	BS
Jumping-slug, malone	*Hemphillia malone*	OR	Invertebrate	BS
Jumping-slug, warty	*Hemphillia glandulosa*	OR	Invertebrate	BS
June beetle, Casey's	*Dinacoma caseyi*	CA	Invertebrate	FP
Junegrass, Oriental	*Koeleria asiatica*	AK	Plant	BS
Kalmiopsis, fragrant (Douglas Co. Population)	*Kalmiopsis fragrans*	OR	Plant	BS
Kangaroo rat, banner-tailed	*Dipodomys spectabilis*	AZ	Mammal	BS
Kangaroo rat, chisel-toothed	*Dipodomys microps*	UT	Mammal	BS
Kangaroo rat, desert	*Dipodomys deserti*	UT	Mammal	BS
Kangaroo rat, Fresno	*Dipodomys nitratoides exilis*	CA	Mammal	FE
Kangaroo rat, giant	*Dipodomys ingens*	CA	Mammal	FE
Kangaroo rat, House Rock Valley chisel-toothed	*Dipodomys microps*	AZ	Mammal	BS
Kangaroo rat, Marysville California	*Dipodomys californicus eximius*	CA	Mammal	BS
Kangaroo rat, Merriam's	*Dipodomys merriami*	UT	Mammal	BS
Kangaroo rat, Morro Bay	*Dipodomys heermanni morroensis*	CA	Mammal	FE
Kangaroo rat, San Bernardino Merriam's	*Dipodomys merriami parvus*	CA	Mammal	FE
Kangaroo rat, short-nosed	*Dipodomys nitratoides brevinasus*	CA, WY	Mammal	BS
Kangaroo rat, Stephens'	*Dipodomys stephensi*	CA, UT	Mammal	FE
Kangaroo rat, Tipton	*Dipodomys nitratoides nitratoides*	CA	Mammal	FE
Kentrophyta, bastard	*Astragalus tegetarioides*	OR	Plant	BS
Kingsnake, California mountain	*Lampropeltis zonata*	CA, OR	Reptile	BS
Kingsnake, common	*Lampropeltis getula*	CO	Reptile	BS
Kingsnake, Sonoran mountain	*Lampropeltis pyromelana*	NV	Reptile	BS
Kingsnake, St. Helena mountain	*Lampropeltis zonata zonata*	CA	Reptile	BS
Kingsnake, Utah mountain	*Lampropeltis pyromelana infralabialis*	UT	Reptile	BS
Kite, white-tailed	*Elanus leucurus*	CA, OR	Bird	BS
Kittenstails, featherleaf	*Synthyris pinnatifida*	OR	Plant	BS
Knotweed, Austin's	*Polygonum douglasii*	MT	Plant	BS
Knotweed, Modoc County	*Polygonum polygaloides*	CA	Plant	BS
Kobresia, Bellard's	*Kobresia bellardii*	OR	Plant	BS
Kruhsea	*Streptopus streptopoides*	OR	Plant	BS

Common Name	Scientific Name	State[1]	Class	Status[2]
Lacewing, cheese-weed moth	*Oliarces clara*	AZ	Invertebrate	BS
Ladies-tresses, Canelo Hills	*Spiranthes delitescens*	AZ	Plant	FE
Ladies-tresses, Ute	*Spiranthes diluvialis*	CO, ID, MT, NV, OR, UT, WY	Plant	FT
Ladies-tresses, western	*Spiranthes porrifolia*	ID, OR	Plant	BS
Lady's-slipper, clustered	*Cypripedium fasciculatum*	CA, ID, OR	Plant	BS
Lady's-slipper, mountain	*Cypripedium montanum*	CA	Plant	BS
Lady's-slipper, small yellow	*Cypripedium parviflorum*	ID, OR	Plant	BS
Lady's-slipper, yellow	*Cypripedium alpinum*	OR	Plant	BS
Lamprey, Alaskan brook	*Lampetra alaskensis*	AK	Fish	BS
Lamprey, Goose Lake	*Lampetra tridentata*	CA, OR	Fish	BS
Lamprey, Miller Lake	*Lampetra minima*	OR	Fish	BS
Lamprey, Pacific	*Lampetra tridentata*	CA, ID	Fish	BS
Lamprey, river	*Lampetra ayresi*	OR	Fish	BS
Lancetooth, hooded	*Ancotrema voyanum*	CA	Invertebrate	BS
Landsnail, Hatchita Grande wood	*Ashmunella hebardi*	OR	Invertebrate	BS
Lanx (snail), rotund	*Lanx subrotundata*	OR	Invertebrate	BS
Lanx (snail), scale	*Lanx klamathensis*	OR	Invertebrate	BS
Laphamia, Inyo	*Perityle inyoensis*	CO, CA	Plant	BS
Lark, streaked horned	*Eremophila alpestris strigata*	OR	Bird	FT
Larkspur, Baker's	*Delphinium bakeri*	CA	Plant	FE
Larkspur, Cuyamaca	*Delphinium hesperium*	CA	Plant	BS
Larkspur, dune	*Delphinium parryi*	CA	Plant	BS
Larkspur, flathead	*Delphinium bicolor*	OR	Plant	BS
Larkspur, Kern County	*Delphinium purpusii*	CA	Plant	BS
Larkspur, Nutall's	*Delphinium nuttallii*	OR	Plant	BS
Larkspur, peacock	*Delphinium pavonaceum*	OR	Plant	BS
Larkspur, recurved	*Delphinium recurvatum*	CA	Plant	BS
Larkspur, red	*Delphinium nudicaule*	OR	Plant	BS
Larkspur, San Clemente Island	*Delphinium variegatum*	CA	Plant	FE
Larkspur, umbrella	*Delphinium umbraculorum*	CA	Plant	BS
Larkspur, Wenatchee	*Delphinium viridescens*	OR	Plant	BS
Larkspur, White Rock	*Delphinium leucophaeum*	OR	Plant	BS
Larkspur, Willamette Valley	*Delphinium oreganum*	OR	Plant	BS
Larkspur, yellow	*Delphinium luteum*	CA	Plant	FE
Layia, beach	*Layia carnosa*	CA	Plant	FE
Layia, Colusa	*Layia septentrionalis*	CA	Plant	BS
Layia, Comanche Point	*Layia leucopappa*	CA	Plant	BS
Layia, Jones's	*Layia jonesii*	CA	Plant	BS
Layia, pale-yellow	*Layia heterotricha*	CA	Plant	BS
Legenere	*Legenere limosa*	CA	Plant	BS

Common Name	Scientific Name	State[1]	Class	Status[2]
Lemming, northern bog	*Synaptomys borealis*	MT	Mammal	BS
Lessingia, San Francisco	*Lessingia germanorum*	CA	Plant	FE
Lewisia, Cantelow's	*Lewisia cantelovii*	CA, OR	Plant	BS
Lewisia, Columbia	*Lewisia columbiana*	OR	Plant	BS
Lewisia, Congdon's	*Lewisia congdonii*	CA	Plant	BS
Lewisia, Heckner's	*Lewisia cotyledon*	CA	Plant	BS
Lewisia, Lee's	*Lewisia leana*	OR	Plant	BS
Lewisia, Purdy's	*Lewisia cotyledon*	OR	Plant	BS
Lewisia, Stebbin's	*Lewisia stebbinsii*	CA	Plant	BS
Lichen	*Bryoria subcana*	OR	Plant	BS
Lichen	*Calicium adspersum*	OR	Plant	BS
Lichen	*Chaenotheca subroscida*	OR	Plant	BS
Lichen	*Dermatocarpon meiophyllizum*	OR	Plant	BS
Lichen	*Erioderma sorediatum*	OR	Plant	BS
Lichen	*Heterodermia leucomela*	OR	Plant	BS
Lichen	*Heterodermia sitchensis*	OR	Plant	BS
Lichen	*Hypogymnia duplicata*	OR	Plant	BS
Lichen	*Hypotrachyna revoluta*	OR	Plant	BS
Lichen	*Leioderma sorediatum*	OR	Plant	BS
Lichen	*Leptogium burnetiae*	OR	Plant	BS
Lichen	*Leptogium cyanescens*	OR	Plant	BS
Lichen	*Microcalicium arenarium*	OR	Plant	BS
Lichen	*Pilophorus nigricaulis*	OR	Plant	BS
Lichen	*Pseudocyphellaria mallota*	OR	Plant	BS
Lichen	*Stereocaulon spathuliferum*	OR	Plant	BS
Lichen	*Tholurna dissimilis*	OR	Plant	BS
Lichen	*Usnea nidulans*	OR	Plant	BS
Lichen, Anderegg's reindeer	*Cladonia andereggii*	ID	Plant	BS
Lichen, ball-bearing	*Sphaerophorus globosus*	ID	Plant	BS
Lichen, dot	*Physcia semipinnata*	ID, OR	Plant	BS
Lichen, earth	*Catapyrenium congestum*	ID	Plant	BS
Lichen, horsehair	*Bryoria pseudocapillaris*	CA, OR	Plant	BS
Lichen, Idaho range	*Xanthoparmelia idahoensis*	ID	Plant	BS
Lichen, long beard	*Usnea longissima*	CA	Plant	BS
Lichen, nail	*Pilophorus acicularis*	ID	Plant	BS
Lichen, orangebush	*Teloschistes flavicans*	CA, OR	Plant	BS
Lichen, powdery fog	*Niebla cephalota*	CA, OR	Plant	BS
Lichen, reindeer	*Cladonia luteoalba*	ID	Plant	BS
Lichen, scurfy jelly	*Collema furfuraceum*	ID	Plant	BS
Lichen, short-spored jelly	*Collema curtisporum*	ID	Plant	BS
Lichen, skin	*Dermatocarpon lorenzianum*	ID	Plant	BS

Common Name	Scientific Name	State[1]	Class	Status[2]
Lichen, stream stippleback	*Dermatocarpon luridum*	NV	Plant	BS
Lichen, transcending reindeer	*Cladonia transcendens*	ID	Plant	BS
Lichen, tube	*Hypogymnia apinnata*	ID	Plant	BS
Lichen, white-dot	*Pseudocyphellaria anthraspis*	ID	Plant	BS
Lichen, worm	*Thamnolia vermicularis*	ID	Plant	BS
Lichen, wovenspore	*Texosporium sancti-jacobi*	ID, OR	Plant	BS
Lily, adobe	*Fritillaria pluriflora*	CA	Plant	BS
Lily, black	*Fritillaria camschatcensis*	OR	Plant	BS
Lily, blue sand	*Triteleiopsis palmeri*	AZ	Plant	BS
Lily, western	*Lilium occidentale*	CA, OR	Plant	FE
Limpet, Banbury Springs	*Lanx* sp.	CA, ID	Invertebrate	FE
Linanthus	*Linanthus* sp.	CA	Plant	BS
Linanthus, Baker's	*Linanthus bolanderi*	OR	Plant	BS
Linanthus, Mount Tedoc	*Linanthus nuttallii* var. *howellii*	CA	Plant	BS
Linanthus, Orcutt's	*Linanthus orcuttii*	CA	Plant	BS
Lip-fern, coastal	*Cheilanthes intertexta*	OR	Plant	BS
Lip-fern, Coville's	*Cheilanthes covillei*	OR	Plant	BS
Lip-fern, Fee's	*Cheilanthes feei*	OR	Plant	BS
Lipocarpha, aristulate	*Lipocarpha aristulata*	OR	Plant	BS
Liveforever, Laguna Beach	*Dudleya stolonifera*	CA	Plant	FT
Liveforever, Santa Barbara Island	*Dudleya traskiae*	CA	Plant	FE
Liverwort	*Barbilophozia lycopodioides*	OR	Plant	BS
Liverwort	*Calypogeia sphagnicola*	OR	Plant	BS
Liverwort	*Chiloscyphus gemmiparus*	OR	Plant	BS
Liverwort	*Cryptomitrium tenerum*	OR	Plant	BS
Liverwort	*Diplophyllum plicatum*	OR	Plant	BS
Liverwort	*Gymnomitrion concinnatum*	OR	Plant	BS
Liverwort	*Herbertus aduncus*	OR	Plant	BS
Liverwort	*Jamsoniella autumnalis*	OR	Plant	BS
Liverwort	*Jungermannia polaris*	OR	Plant	BS
Liverwort	*Kurzia makinoana*	OR	Plant	BS
Liverwort	*Lophozia laxa*	OR	Plant	BS
Liverwort	*Metzgeria violacea*	OR	Plant	BS
Liverwort	*Peltolepis quadrata*	OR	Plant	BS
Liverwort	*Porella bolanderi*	OR	Plant	BS
Liverwort	*Ptilidium pulcherrimum*	OR	Plant	BS
Liverwort	*Sphaerocarpos hians*	OR	Plant	BS
Liverwort	*Tritomaria exsectiformis*	OR	Plant	BS
Lizard, blunt-nosed leopard	*Gambelia silus (=sila)*	CA	Reptile	FE
Lizard, California horned	*Phrynosoma coronatum*	CA, NV	Reptile	BS

Common Name	Scientific Name	State[1]	Class	Status[2]
Lizard, Coachella Valley fringe-toed	*Uma inornata*	CA	Reptile	FT
Lizard, coast horned	*Phrynosoma blainvillii*	CA	Reptile	BS
Lizard, Colorado desert fringe-toed	*Uma notata*	CA	Reptile	BS
Lizard, desert night	*Xantusia vigilis*	UT	Reptile	BS
Lizard, desert spiny	*Sceloporus magister*	CO, UT	Reptile	BS
Lizard, dunes sagebrush	*Sceloporus arenicolus*	NM	Reptile	C
Lizard, flat-tailed horned	*Phrynosoma mcalli*	CA, CO	Reptile	BS
Lizard, greater short-horned	*Phrynosoma hernandesi*	MT	Reptile	BS
Lizard, island night	*Xantusia riversiana*	CA	Reptile	FT
Lizard, longnose leopard	*Gambelia wislizenii*	CA, CO	Reptile	BS
Lizard, Mohave fringe-toed	*Uma scoparia*	AZ, CA	Reptile	BS
Lizard, Mojave black-collared	*Crotaphytus bicinctores*	UT	Reptile	BS
Lizard, northern sagebrush	*Sceloporus graciosus graciosus*	AZ, CA, OR	Reptile	BS
Lizard, panamint alligator	*Elgaria panamintinus*	CA	Reptile	BS
Lizard, Shasta alligator	*Elgaria coerulea*	NV	Reptile	BS
Lizard, side-blotched	*Uta stansburiana*	OR	Reptile	BS
Lizard, slevins bunchgrass	*Sceloporus slevini*	AZ	Reptile	BS
Lizard, Texas horned	*Phrynosoma cornutum*	AZ, CO, NM	Reptile	BS
Lizard, Utah night	*Xantusia vigilis utahensis*	UT	Reptile	BS
Lizard, Yuman desert fringe-toed (Cowles fringe-toed)	*Uma rufopunctata*	AZ	Reptile	BS
Lizard, zebra-tailed	*Callisaurus draconoides*	UT	Reptile	BS
Lobelia, Kalm's	*Lobelia kalmii*	OR	Plant	BS
Lobelia, pale-spiked	*Lobelia spicata*	MT	Plant	BS
Lobelia, water	*Lobelia dortmanna*	OR	Plant	BS
Locoweed, Barneby's	*Oxytropis arctica*	AK	Plant	BS
Locoweed, Huddelson's	*Oxytropis huddelsonii*	AK	Plant	BS
Locoweed, Kobuk	*Oxytropis kobukensis*	AK	Plant	BS
Locoweed, white	*Oxytropis sericea*	OR	Plant	BS
Loeflingia, sagebrush	*Loeflingia squarrosa* ssp. *artemisiarum*	CA	Plant	BS
Lomatium, adobe	*Lomatium roseanum*	CA	Plant	BS
Lomatium, Congdon's	*Lomatium congdonii*	CA	Plant	BS
Lomatium, Cook's	*Lomatium cookii*	OR	Plant	FE
Lomatium, Ochoco	*Lomatium ochocense*	OR	Plant	BS
Lomatium, Owens Peak	*Lomatium shevockii*	CA	Plant	BS
Lomatium, Raven's	*Lomatium ravenii*	OR	Plant	BS
Lomatium, red-fruited	*Lomatium erythrocarpum*	OR	Plant	BS
Lomatium, Suksdorf's	*Lomatium suksdorfii*	OR	Plant	BS
Longspur, chestnut-collared	*Calcarius ornatus*	MT	Bird	BS

Common Name	Scientific Name	State[1]	Class	Status[2]
Longspur, McCown's	*Calcarius mccownii*	MT	Bird	BS
Loon, common	*Gavia immer*	MT, OR	Bird	BS
Loon, yellow-billed	*Gavia adamsii*	AK	Bird	C
Lotus, red-flowered	*Lotus rubriflorus*	CA	Plant	BS
Lotus, scrub	*Lotus argyraeus*	CA, NV	Plant	BS
Lousewort, dwarf	*Pedicularis centranthera*	CA	Plant	BS
Lousewort, meadow	*Pedicularis crenulata*	MT	Plant	BS
Lousewort, Mount Rainier	*Pedicularis rainierensis*	OR	Plant	BS
Luina, colonial	*Luina serpentina*	OR	Plant	BS
Lung, lettuce	*Lobaria oregano*	CA	Plant	BS
Lungwort, Hall's	*Lobaria hallii*	ID	Plant	BS
Lungwort, pored	*Lobaria scrobiculata*	ID	Plant	BS
Lungwort, smeared	*Lobaria linita*	ID, OR	Plant	BS
Lupine, Anthony Peak	*Lupinus antoninus*	CA	Plant	BS
Lupine, clover	*Lupinus tidestromii*	CA	Plant	FE
Lupine, Cobb Mountain	*Lupinus sericatus*	CA	Plant	BS
Lupine, Cusick's	*Lupinus lepidus*	OR	Plant	BS
Lupine, Holmgren	*Lupinus holmgrenianus*	NV	Plant	BS
Lupine, inch-high	*Lupinus uncialis*	CA, ID	Plant	BS
Lupine, Kincaid's	*Lupinus sulphureus* ssp. *kincaidii*	OR	Plant	FT
Lupine, Mariposa	*Lupinus citrinus*	CA	Plant	BS
Lupine, Mcgee Meadows	*Lupinus magnificus*	CA	Plant	BS
Lupine, Mono Lake	*Lupinus duranii*	CA	Plant	BS
Lupine, Mountain Springs bush	*Lupinus excubitus*	CA	Plant	BS
Lupine, Nevada	*Lupinus nevadensis*	OR	Plant	BS
Lupine, Nipomo Mesa	*Lupinus nipomensis*	CA	Plant	FE
Lupine, orange	*Lupinus citrinus*	CA	Plant	BS
Lupine, Panamint Mountains	*Lupinus magnificus*	CA	Plant	BS
Lupine, Paradox Valley	*Lupinus crassus*	CO	Plant	BS
Lupine, Quincy	*Lupinus dalesiae*	CA	Plant	BS
Lupine, Sabine's	*Lupinus sabinianus*	OR	Plant	BS
Lupine, San Luis	*Lupinus ludovicianus*	CA	Plant	BS
Lupine, shaggyhair	*Lupinus spectabilis*	CA	Plant	BS
Lupine, Tracy's	*Lupinus tracyi*	OR	Plant	BS
Lynx, Canada	*Lynx canadensis*	AK, CO, ID, MT, NM, OR, UT, WY	Mammal	FT/PT
Madia, Hall's	*Madia hallii*	CA	Plant	BS
Madia, Niles'	*Madia doris-nilesiae*	CA	Plant	BS
Madia, showy	*Madia radiata*	CA	Plant	BS
Madia, Stebbins's	*Harmonia stebbinsii* (=*Madia stebbinsii*)	CA	Plant	BS

Common Name	Scientific Name	State[1]	Class	Status[2]
Maiden-hair, California	*Adiantum jordanii*	OR	Plant	BS
Malacothrix, Carmel Valley	*Malacothrix saxatilis*	CA	Plant	BS
Malacothrix, island	*Malacothrix squalida*	CA	Plant	FE
Malacothrix, lyrate	*Malacothrix sonchoides*	OR	Plant	BS
Malacothrix, Santa Cruz Island	*Malacothrix indecora*	CA	Plant	FE
Mallow, Carmel Valley bush	*Malacothamnus palmeri*	CA	Plant	BS
Mallow, Davidson's bush	*Malacothamnus davidsonii*	CA	Plant	BS
Mallow, Gierisch	*Sphaeralcea gierischii*	AZ, UT	Plant	FE
Mallow, Indian Valley bush	*Malocothamnus aboriginum*	CA	Plant	BS
Mallow, Kern	*Eremalche kernensis*	CA, UT	Plant	FE
Mallow, Pima Indian	*Abutilon parishii*	AZ	Plant	BS
Manzanita, Arroyo de la Cruz	*Arctostaphylos cruzensis*	CA	Plant	BS
Manzanita, Del Mar	*Arctostaphylos glandulosa*	CA	Plant	FE
Manzanita, Gabilan Mountains	*Arctostaphylos gabilanensis*	CA	Plant	BS
Manzanita, hairy	*Arctostaphylos hispidula*	OR	Plant	BS
Manzanita, Hooker's	*Arctostaphylos hookeri* ssp. *hookeri*	CA	Plant	BS
Manzanita, Ione	*Arctostaphylos myrtifolia*	CA, UT	Plant	FT
Manzanita, Klamath	*Arctostaphylos klamathensis*	CA	Plant	BS
Manzanita, Monterey	*Arctostaphylos montereyensis*	CA	Plant	BS
Manzanita, Morro	*Arctostaphylos morroensis*	CA	Plant	FT
Manzanita, Nissenan	*Arctostaphylos nissenana*	CA	Plant	BS
Manzanita, Otay	*Arctostaphylos otayensis*	CA	Plant	BS
Manzanita, Pajaro	*Arctostaphylos pajaroensis*	CA	Plant	BS
Manzanita, Pallid	*Arctostaphylos pallida*	CA	Plant	FT
Manzanita, Presidio	*Arctostaphylos hookeri* var. *ravenii*	CA	Plant	FE
Manzanita, Sand Mesa	*Arctostaphylos rudis*	CA	Plant	BS
Manzanita, sandmat	*Arctostaphylos pumila*	CA	Plant	BS
Manzanita, Santa Margarita	*Arctostaphylos pilosula*	CA	Plant	BS
Manzanita, Santa Rosa Island	*Arctostaphylos confertiflora*	CA	Plant	FE
Manzanita, Sonoma canescent	*Arctostaphylos cansecens*	CA	Plant	BS
Marble, island large	*Euchloe ausonides*	OR	Invertebrate	BS
Mariposa lily, alkali	*Calochortus striatus*	CA, NV	Plant	BS
Mariposa lily, Arroyo de la Cruz	*Calochortus clavatus* var. *recurvifolius*	CA	Plant	BS
Mariposa lily, broad-fruit	*Calochortus nitidus*	ID, OR	Plant	BS
Mariposa lily, crinite	*Calochortus coxii*	OR	Plant	BS
Mariposa lily, Dunn's	*Calochortus dunnii*	CA	Plant	BS
Mariposa lily, green-band	*Calochortus macrocarpus*	ID, OR	Plant	BS
Mariposa lily, Greene's	*Calochortus greenei*	CA, OR	Plant	BS
Mariposa lily, Howell's	*Calochortus howellii*	OR	Plant	BS
Mariposa lily, Inyo	*Calochortus excavatus*	CA	Plant	BS

Common Name	Scientific Name	State[1]	Class	Status[2]
Mariposa lily, long-bearded Peck's	*Calochortus longebarbatus* var. *peckii*	CA, OR	Plant	BS
Mariposa lily, one-leaved	*Calochortus monophyllus*	OR	Plant	BS
Mariposa lily, Pleasant Valley	*Calochortus clavatus* var. *avius*	CA	Plant	BS
Mariposa lily, San Luis	*Calochortus obispoensis*	CA	Plant	BS
Mariposa lily, San Luis Obispo	*Calochortus simulans*	CA	Plant	BS
Mariposa lily, Sexton Mountain	*Calochortus indecorus*	OR	Plant	BS
Mariposa lily, Shasta River	*Calochortus monanthus*	CA	Plant	BS
Mariposa lily, Siskiyou	*Calochortus persistens*	CA, OR	Plant	C
Mariposa lily, Tiburon	*Calochortus tiburonensis*	CA	Plant	FT
Mariposa lily, Umpqua	*Calochortus umpquaensis*	OR	Plant	C
Marsh lily, Pitkin	*Lilium pardalinum*	CA	Plant	FE
Marsh-pennywort, whorled	*Hydrocotyle verticillata*	OR	Plant	BS
Marsh-rosemary, western	*Limonium californicum*	OR	Plant	BS
Marten	*Martes americana*	UT	Mammal	BS
Marten, Kenai	*Mustela americana* ssp.	AK	Mammal	BS
Martin, desert purple	*Progne subis*	AZ	Bird	BS
Martin, purple	*Progne subis*	MT, OR	Bird	BS
Massasauga	*Sistrurus catenatus*	CO	Reptile	BS
Mayfly	*Acentrella feropagus*	AK	Invertebrate	BS
Mayfly, Alaska endemic	*Rhithrogena ingalik*	AK	Invertebrate	BS
Meadowfoam, Baker's	*Limnanthes bakeri*	CA	Plant	BS
Meadowfoam, Bellinger's	*Limnanthes floccosa* ssp. *bellingeriana*	CA, OR	Plant	BS
Meadowfoam, Butte County	*Limnanthes floccosa* ssp. *californica*	CA	Plant	FE
Meadowfoam, Cuyamaca	*Limnanthes gracilis*	CA	Plant	BS
Meadowfoam, dwarf	*Limnanthes floccosa* ssp. *pumila*	OR	Plant	BS
Meadowfoam, large-flowered woolly	*Limnanthes floccosa* ssp. *grandiflora*	OR	Plant	FE
Meadowfoam, Sebastopol	*Limnanthes vinculans*	CA	Plant	FE
Meadowfoam, slender	*Limnanthes gracilis* ssp. *gracilis*	OR	Plant	BS
Meadowfoam, wooly	*Limnanthes floccosa* ssp. *floccosa*	OR	Plant	FP/FE
Meadowlark, western	*Sturnella neglecta*	ID	Bird	BS
Meadowrue, alpine	*Thalictrum alpinum*	MT, OR	Plant	BS
Meadowrue, Cathedral Bluff	*Thalictrum heliophilum*	CO	Plant	BS
Meadowrue, purple	*Thalictrum dasycarpum*	ID, OR	Plant	BS
Mecca-aster	*Xylorhiza cognata*	CA	Plant	BS
Meesia	*Meesia longiseta*	CA	Invertebrate	BS
Mentzelia, bractless	*Mentzelia nuda*	MT	Plant	BS

Common Name	Scientific Name	State[1]	Class	Status[2]
Mentzelia, dwarf	*Mentzelia pumila*	MT	Plant	BS
Mentzelia, Packard's	*Mentzelia packardiae*	OR	Plant	BS
Mesa-mint, Otay	*Pogogyne nudiuscula*	CA	Plant	FE
Mesa-mint, San Diego	*Pogogyne abramsii*	CA	Plant	FE
Microseris, coast	*Microseris bigelovii*	OR	Plant	BS
Microseris, Detling's	*Microseris laciniata*	CA	Plant	BS
Microseris, Howell's	*Microseris howellii*	OR	Plant	BS
Microseris, northern	*Microseris borealis*	OR	Plant	BS
Milk-vetch, Ames' (= Suksdorf's milk-vetch)	*Astragalus pulsiferae* var. *suksdorfii*	CA, NV	Plant	BS
Milk-vetch, Applegate's	*Astragalus applegatei*	OR	Plant	FE
Milk-vetch, Aquarius Mountain	*Astragalus newberryi* var. *aquarii*	AZ	Plant	BS
Milk-vetch, Arthur's	*Astragalus arthurii*	OR	Plant	BS
Milk-vetch, Ash Meadows	*Astragalus phoenix*	CA, NV	Plant	FT
Milk-vetch, Ash Valley	*Astragalus anxius*	CA	Plant	BS
Milk-vetch, Asotin	*Astragalus asotinensis*	OR	Plant	BS
Milk-vetch, Barneby egg	*Astragalus oophorus* var. *lonchocalyx*	NV	Plant	BS
Milk-vetch, barren	*Astragalus sterilis*	ID	Plant	BS
Milk-vetch, Barr's	*Astragalus barrii*	MT	Plant	BS
Milk-vetch, Bitterroot	*Astragalus scaphoides*	MT	Plant	BS
Milk-vetch, black (black woolly-pod)	*Astragalus funereus*	CA, NV	Plant	BS
Milk-vetch, Brandegee	*Astragalus brandegeei*	CO	Plant	BS
Milk-vetch, Braunton's	*Astragalus brauntonii*	CA	Plant	FE
Milk-vetch, broad-keeled	*Astragalus platytropis*	OR	Plant	BS
Milk-vetch, California	*Astragalus californicus*	OR	Plant	BS
Milk-vetch, Challis	*Astragalus amblytropis*	ID	Plant	BS
Milk-vetch, Cima	*Astragalus cimae*	NV	Plant	BS
Milk-vetch, Clara Hunt's	*Astragalus clarianus*	CA	Plant	FE
Milk-vetch, cliff	*Astragalus cremnophylax* var. *myriorraphus*	AZ	Plant	BS
Milk-vetch, Clokey's	*Astragalus aequalis*	NV	Plant	BS
Milk-vetch, Coachella Valley	*Astragalus lentiginosus* var. *coachellae*	CA, UT	Plant	FE
Milk-vetch, coastal dunes	*Astragalus tener* var. *titi*	CA	Plant	FE
Milk-vetch, coastal marsh	*Astragalus pycnostachyus*	CA	Plant	BS
Milk-vetch, Columbia	*Astragalus columbianus*	OR	Plant	BS
Milk-vetch, Cotton's	*Astragalus australis*	OR	Plant	BS
Milk-vetch, Cronquist	*Astragalus cronquistii*	CO	Plant	BS
Milk-vetch, currant	*Astragalus uncialis*	NV	Plant	BS

Common Name	Scientific Name	State[1]	Class	Status[2]
Milk-vetch, curved-pod Mojave	*Astragalus mohavensis* ssp. *hemigyrus*	CA, NV	Plant	BS
Milk-vetch, Cushenbury	*Astragalus albens*	CA	Plant	FE
Milk-vetch, Cusick's	*Astragalus cusickii* var. *cusickii*	OR	Plant	BS
Milk-vetch, Deane's	*Astragalus deanei*	CA	Plant	BS
Milk-vetch, Debeque	*Astragalus debequaeus*	CO	Plant	BS
Milk-vetch, debris	*Astragalus detritalis*	CO	Plant	BS
Milk-vetch, Descanso	*Astragalus oocarpus*	CA	Plant	BS
Milk-vetch, Deseret	*Astragalus desereticus*	UT	Plant	FT
Milk-vetch, Diamond Butte	*Astragalus toanus*	AZ	Plant	BS
Milk-vetch, Drummond's	*Astragalus drummondii*	ID	Plant	BS
Milk-vetch, Dubois	*Astragalus gilviflorus* var. *purpureus*	WY	Plant	BS
Milk-vetch, Duchesne	*Astragalus duchesnensis*	CO	Plant	BS
Milk-vetch, Ferris'	*Astragalus tener* var. *ferrisae*	CA	Plant	BS
Milk-vetch, Ferron's	*Astragalus musiniensis*	CO	Plant	BS
Milk-vetch, field	*Astragalus agrestis*	CA	Plant	BS
Milk-vetch, Fish Slough	*Astragalus lentiginosus* var. *piscinensis*	CA	Plant	FT
Milk-vetch, Fisher Towers	*Astragalus piscator*	CO	Plant	BS
Milk-vetch, four-wing	*Astragalus tetrapterus*	ID, WY	Plant	BS
Milk-vetch, Gambel	*Astragalus gambelianus*	OR	Plant	BS
Milk-vetch, Geyer's	*Astragalus geyeri* var. *geyeri*	CA, MT, OR	Plant	BS
Milk-vetch, Gilman's	*Astragalus gilmanii*	NV	Plant	BS
Milk-vetch, Goose creek	*Astragalus anserinus*	CO, ID, NV, UT	Plant	C
Milk-vetch, Grand Junction	*Astragalus linifolius*	CO	Plant	BS
Milk-vetch, Gray's	*Astragalus grayi*	MT	Plant	BS
Milk-vetch, Gunnison	*Astragalus anisus*	CO	Plant	BS
Milk-vetch, heliotrope	*Astragalus montii*	UT	Plant	FT
Milk-vetch, Holmgren	*Astragalus holmgreniorum*	AZ, UT	Plant	FE
Milk-vetch, Horn's	*Astragalus hornii*	CA	Plant	BS
Milk-vetch, horseshoe	*Astragalus equisolensis*	CA, UT	Plant	C
Milk-vetch, Huachuca	*Astragalus hypoxylus*	AZ	Plant	BS
Milk-vetch, Humboldt	*Astragalus agnicidus*	CA	Plant	BS
Milk-vetch, Hyattville	*Astragalus jejunus* var. *articulatus*	WY	Plant	BS
Milk-vetch, Jacumba	*Astragalus douglasii*	CA	Plant	BS
Milk-vetch, Jepson's	*Astragalus rattanii*	CA	Plant	BS
Milk-vetch, Lane Mountain	*Astragalus jaegerianus*	CA	Plant	FE
Milk-vetch, Laurence's	*Astragalus collinus*	OR	Plant	BS

Common Name	Scientific Name	State[1]	Class	Status[2]
Milk-vetch, Lavin's	*Astragalus oophorus* var. *lavinii*	CA, NV	Plant	BS
Milk-vetch, least bladdery	*Astragalus microcystis*	OR	Plant	BS
Milk-vetch, Lemhi	*Astragalus aquilonius*	ID	Plant	BS
Milk-vetch, Lemmon's	*Astragalus lemmonii*	CA	Plant	BS
Milk-vetch, lens-pod	*Astragalus lentiformis*	CA	Plant	BS
Milk-vetch, lesser rushy	*Astragalus convallarius*	MT	Plant	BS
Milk-vetch, lonesome	*Astragalus solitarius*	NV	Plant	BS
Milk-vetch, Long Valley	*Astragalus johannis-howellii*	CA	Plant	BS
Milk-vetch, Lost River	*Astragalus amnis-amissi*	ID	Plant	BS
Milk-vetch, Mancos	*Astragalus humillimus*	CO, NM	Plant	FE
Milk-vetch, Marble Canyon	*Astragalus cremnophylax* var. *hevronii*	AZ	Plant	BS
Milk-vetch, Margaret Rushy	*Astragalus convallarious var. margaretiae*	NV	Plant	BS
Milk-vetch, meadow	*Astragalus diversifolius*	ID, WY	Plant	BS
Milk-vetch, Mokiak	*Astragalus mokiacensis*	NV	Plant	BS
Milk-vetch, Mono	*Astragalus monoensis*	CA	Plant	BS
Milk-vetch, mourning	*Astragalus atratus* var. *mensanus*	CA, ID	Plant	BS
Milk-vetch, Mulford's	*Astragalus mulfordiae*	ID, OR	Plant	BS
Milk-vetch, Naturita	*Astragalus naturitensis*	CO	Plant	BS
Milk-vetch, Needle Mountains	*Astragalus eurylobus*	NV	Plant	BS
Milk-vetch, Nelson	*Astragalus nelsonianus*	CO, WY	Plant	BS
Milk-vetch, Newberry's	*Astragalus newberryi* var. *castoreus*	ID	Plant	BS
Milk-vetch, Osgood Mountains	*Astragalus yoder-williamsii*	ID, NV	Plant	BS
Milk-vetch, Osterhout	*Astragalus osterhoutii*	CO	Plant	FE
Milk-vetch, Packard's	*Astragalus cusickii* var. *packardii*	ID	Plant	C
Milk-vetch, painted	*Astragalus ceramicus*	MT	Plant	BS
Milk-vetch, Palouse	*Astragalus arrectus*	OR	Plant	BS
Milk-vetch, park	*Astragalus leptaleus*	ID	Plant	BS
Milk-vetch, pauper	*Astragalus misellus*	OR	Plant	BS
Milk-vetch, Payson's	*Astragalus paysonii*	ID	Plant	BS
Milk-vetch, Peck's	*Astragalus peckii*	OR	Plant	BS
Milk-vetch, picabo	*Astragalus oniciformis*	ID	Plant	BS
Milk-vetch, Pierson's	*Astragalus magdalenae* var. *peirsonii*	CA	Plant	FT
Milk-vetch, Pipers	*Astragalus riparius*	OR	Plant	BS
Milk-vetch, plains	*Astragalus gilviflorus*	ID	Plant	BS
Milk-vetch, precocious	*Astragalus proimanthus*	WY	Plant	BS
Milk-vetch, Pulsifer's	*Astragalus pulsiferae* var. *pulsiferae*	CA	Plant	BS

Common Name	Scientific Name	State[1]	Class	Status[2]
Milk-vetch, railhead	*Astragalus terminalis*	ID, MT	Plant	BS
Milk-vetch, Ripley's	*Astragalus ripleyi*	CO	Plant	BS
Milk-vetch, San Rafeal	*Astragalus rafaelensis*	CO	Plant	BS
Milk-vetch, sandstone	*Astragalus sesquiflorus*	CO	Plant	BS
Milk-vetch, Schmoll	*Astragalus schmolliae*	CO	Plant	C
Milk-vetch, sentry	*Astragalus cremnophylax* var. *cremnophylax*	AZ	Plant	FE
Milk-vetch, Shevock's	*Astragalus shevockii*	CA	Plant	BS
Milk-vetch, Shivwitz	*Astragalus ampullarioides*	UT	Plant	FE
Milk-vetch, silverleaf	*Astragalus argophyllus*	CA	Plant	BS
Milk-vetch, skiff	*Astragalus microcymbus*	CO	Plant	C
Milk-vetch, sleeping Ute	*Astragalus tortipes*	CO	Plant	C
Milk-vetch, Snake River	*Astragalus purshii*	ID	Plant	BS
Milk-vetch, Sodaville	*Astragalus lentiginosus* ssp. *sesquimetralis*	NV	Plant	BS
Milk-vetch, South Fork John Day	*Astragalus diaphanus*	OR	Plant	BS
Milk-vetch, spine-noded	*Peteria thompsoniae*	ID	Plant	BS
Milk-vetch, Spring Mountains	*Astragalus remotus*	NV	Plant	BS
Milk-vetch, starveling	*Astragalus jejunus* var. *jejunus*	CO, ID	Plant	BS
Milk-vetch, sterile	*Astragalus cusickii* var. *sterilis*	OR	Plant	BS
Milk-vetch, straw	*Astragalus lentiginosus*	NV	Plant	BS
Milk-vetch, Sweetwater	*Astragalus aretioides*	CO, MT	Plant	BS
Milk-vetch, three-corner	*Astragalus geyeri* var. *triquetris*	AZ, NV	Plant	BS
Milk-vetch, Tiehm's	*Astragalus tiehmii*	CA, NV	Plant	BS
Milk-vetch, Tonopah	*Astragalus pseudiodanthus*	CA, NV	Plant	BS
Milk-vetch, Toquima	*Astragalus toquimanus*	NV	Plant	BS
Milk-vetch, Torrey	*Astragalus calycosus*	NV, OR	Plant	BS
Milk-vetch, Trelease's	*Astragalus racemosus*	WY	Plant	BS
Milk-vetch, triple-ribbed	*Astragalus tricarinatus*	CA	Plant	FE
Milk-vetch, Trout Creek	*Astragalus salmonis*	ID	Plant	BS
Milk-vetch, two-grooved	*Astragalus bisulcatus*	ID	Plant	BS
Milk-vetch, Tygh Valley	*Astragalus tyghensis*	OR	Plant	BS
Milk-vetch, Ventura Marsh	*Astragalus pycnostachyus* var. *lanosissimus*	CA	Plant	FE
Milk-vetch, Veyo	*Astragalus ensiformis*	NV	Plant	BS
Milk-vetch, Walker Pass	*Astragalus ertterae*	CA	Plant	BS
Milk-vetch, Webber's	*Astragalus webberi*	CA	Plant	BS
Milk-vetch, Whited	*Astragalus sinuatus*	OR	Plant	BS
Milk-vetch, Wind River	*Astragalus oreganus*	MT	Plant	BS

Common Name	Scientific Name	State[1]	Class	Status[2]
Milkweed, dwarf	*Asclepias uncialis*	CO	Plant	BS
Milkweed, Eastwood	*Asclepias eastwoodiana*	NV	Plant	BS
Milkweed, narrowleaf	*Asclepias stenophylla*	MT	Plant	BS
Milkweed, Welsh's	*Asclepias welshii*	AZ, UT	Plant	FT
Miners-lettuce, Bostock's	*Montia bostockii*	AK	Plant	BS
Minnow, loach	*Tiaroga cobitis*	AZ, NM	Fish	FE
Minnow, Rio Grande silvery	*Hybognathus amarus*	NM	Fish	FE
Mistmaiden, Thompson	*Romanzoffia thompsonii*	OR	Plant	BS
Molly, green	*Kochia americana*	MT	Plant	BS
Monardella, crisp	*Monardella crispa*	CA	Plant	BS
Monardella, flax-like	*Monardella linoides*	CA	Plant	BS
Monardella, Jennifer's	*Monardella stoneana*	CA	Plant	BS
Monardella, Robison	*Monardella robisonii*	CA	Plant	BS
Monardella, robust	*Monardella villosa*	CA	Plant	BS
Monardella, San Luis Obispo	*Monardella frutescens*	CA	Plant	BS
Monardella, sweet-smelling	*Monardella beneolens*	CA	Plant	BS
Monardella, veiny	*Monardella douglasii*	CA	Plant	BS
Monardella, willowy	*Monardella viminea*	CA	Plant	FE
Monkeyflower	*Mimulus* sp.	CA	Plant	BS
Monkeyflower, Bolander's	*Mimulus bolanderi*	OR	Plant	BS
Monkeyflower, broad-toothed	*Mimulus latidens*	OR	Plant	BS
Monkeyflower, Calico	*Mimulus pictus*	CA	Plant	BS
Monkeyflower, Congdon's	*Mimulus congdonii*	OR	Plant	BS
Monkeyflower, Cusick	*Mimulus cusickii*	OR	Plant	BS
Monkeyflower, disappearing	*Mimulus evanescens*	CA, OR	Plant	BS
Monkeyflower, dwarf purple	*Mimulus nanus*	MT	Plant	BS
Monkeyflower, Eastwood	*Mimulus eastwoodiae*	CO, OR	Plant	BS
Monkeyflower, Kaweah	*Mimulus norrisii*	CA, CO	Plant	BS
Monkeyflower, liverwort	*Mimulus jungermannioides*	CA	Plant	BS
Monkeyflower, membrane-leaved	*Mimulus hymenophyllus*	ID, OR	Plant	BS
Monkeyflower, Mojave	*Mimulus mohavensis*	CA	Plant	BS
Monkeyflower, pansy	*Mimulus pulchellus*	CA	Plant	BS
Monkeyflower, primrose	*Mimulus primuloides*	MT	Plant	BS
Monkey-flower, Pulsifer's	*Mimulus pulsiferae*	OR	Plant	BS
Monkeyflower, pygmy	*Mimulus pygmaeus*	CA	Plant	BS
Monkeyflower, Shevock's	*Mimulus shevockii*	CA	Plant	BS
Monkeyflower, slender-stalked	*Mimulus gracilipes*	CA	Plant	BS
Monkeyflower, slender-stemmed	*Mimulus filicaulis*	CA	Plant	BS
Monkeyflower, spacious	*Mimulus washingtonensis*	ID	Plant	BS
Monkeyflower, square-stem	*Mimulus ringens*	MT	Plant	BS
Monkeyflower, stalke-leaved	*Mimulus patulus*	ID, OR	Plant	BS

Common Name	Scientific Name	State[1]	Class	Status[2]
Monkey-flower, Suksdorf's	*Mimulus suksdorfii*	OR	Plant	BS
Monkey-flower, three-colored	*Mimulus tricolor*	OR	Plant	BS
Monkeyflower, Vandenberg	*Mimulus fremontii*	CA	Plant	C
Monster, gila	*Heloderma suspectum*	CA, UT	Reptile	BS
Montia, branching	*Montia diffusa*	OR	Plant	BS
Moonpod, desert	*Selinocarpus diffusus*	AZ	Plant	BS
Moonpod, goosefoot	*Ammocodon chenopodioides*	AZ	Plant	BS
Moonwort	*Botrychium lunaria*	OR	Plant	BS
Moonwort, least	*Botrychium simplex*	ID	Plant	BS
Moonwort, Mingan	*Botrychium minganense*	ID, OR	Plant	BS
Moonwort, northern	*Botrychium pinnatum*	ID	Plant	BS
Moonwort, prairie	*Botrychium campestre*	OR	Plant	BS
Moonwort, scalloped	*Botrychium crenulatum*	CA, ID, NV, OR	Plant	BS
Moonwort, slender	*Botrychium lineare*	CO, ID, OR, UT, WY	Plant	C
Moonwort, stalked	*Botrychium pedunculosum*	OR	Plant	BS
Moonwort, twin-spiked	*Botrychium paradoxum*	MT, OR	Plant	BS
Moonwort, upward-lobed	*Botrychium ascendens*	AK, ID, OR	Plant	BS
Moonwort, western	*Botrychium hesperium*	OR	Plant	BS
Moose	*Alces americanus*	OR	Mammal	BS
Morning-glory, Stebbins'	*Calystegia stebbinsii*	CA	Plant	FE
Morning-glory, three-fingered	*Calystegia collina*	CA	Plant	BS
Moss	*Andreaea schofieldiana*	OR	Plant	BS
Moss	*Campylopus schmidii*	OR	Plant	BS
Moss	*Codriophorus depressus*	OR	Plant	BS
Moss	*Encalypta brevicollis*	OR	Plant	BS
Moss	*Encalypta brevipes*	OR	Plant	BS
Moss	*Encalypta intermedia*	OR	Plant	BS
Moss	*Entosthodon fascicularis*	OR	Plant	BS
Moss	*Ephemerum crassinervium*	OR	Plant	BS
Moss	*Iwatsukiella leucotricha*	OR	Plant	BS
Moss	*Limbella fryei*	OR	Plant	BS
Moss	*Meesia uliginosa*	OR	Plant	BS
Moss	*Orthodontium pellucens*	OR	Plant	BS
Moss	*Polytrichum sphaerothecium*	OR	Plant	BS
Moss	*Pseudocalliergon trifarium*	OR	Plant	BS
Moss	*Rhizomnium nudum*	OR	Plant	BS
Moss	*Rhytidium rugosum*	OR	Plant	BS
Moss	*Schistidium cinclidodonteum*	OR	Plant	BS
Moss	*Schistostega pennata*	OR	Plant	BS
Moss	*Scouleria marginata*	OR	Plant	BS

Common Name	Scientific Name	State[1]	Class	Status[2]
Moss	*Splachnum ampullaceum*	OR	Plant	BS
Moss	*Tayloria serrata*	OR	Plant	BS
Moss	*Tetraplodon mnioides*	OR	Plant	BS
Moss	*Tomentypnum nitens*	OR	Plant	BS
Moss	*Tortula californica*	CA	Plant	BS
Moss	*Tortula mucronifolia*	OR	Plant	BS
Moss	*Trematodon boasii*	OR	Plant	BS
Moss, bent-kneed four-tooth	*Tetraphis geniculata*	CA, OR	Plant	BS
Moss, Gold Butte	*Didymodon nevadensis*	NV	Plant	BS
Moss, green bug	*Buxbaumia viridis*	CA	Plant	BS
Moss, slender thread	*Orthodontium gracile*	CA	Plant	BS
Moth, Kern primrose sphinx	*Euproserpinus euterpe*	CA	Invertebrate	FT
Mountain balm, Indian Knob	*Eriodictyon altissimum*	CA	Plant	FE
Mountain beaver, Point Arena	*Aplodontia rufa nigra*	CA	Mammal	FE
Mountain-avens, yellow	*Dryas drummondii*	OR	Plant	BS
Mountain-mahogany, Catalina Island	*Cercocarpus traskiae*	CA	Plant	FE
Mountain-parsley, purple	*Oreonana purpurascens*	CA	Plant	BS
Mountainsnail, boulder pile	*Oreohelix jugalis*	ID	Invertebrate	BS
Mountainsnail, carinated striate banded	*Oreohelix strigosa*	OR	Invertebrate	BS
Mountainsnail, Chelan	*Oreohelix* sp.	OR	Invertebrate	BS
Mountainsnail, Deschutes	*Oreohelix variabilis*	OR	Invertebrate	BS
Mountainsnail, Idaho banded	*Oreohelix idahoensis*	ID	Invertebrate	BS
Mountainsnail, lava rock	*Oreohelix waltoni*	ID	Invertebrate	BS
Mountainsnail, Ogden deseret	*Oreohelix periphera*	UT	Invertebrate	C
Mountainsnail, whorled	*Oreohelix vortex*	ID	Invertebrate	BS
Mouse, cactus	*Peromyscus torridus*	UT	Mammal	BS
Mouse, dark kangaroo	*Microdipodops megacephalus*	ID, NV, UT	Mammal	BS
Mouse, Great Basin pocket	*Perognathus parvus*	MT	Mammal	BS
Mouse, meadow jumping	*Zapus hudsonius*	MT	Mammal	BS
Mouse, New Mexico meadow jumping	*Zapus hudsonius luteus*	AZ, CO, NM	Mammal	FE
Mouse, northern rock	*Peromyscus nasutus*	UT	Mammal	BS
Mouse, olive-backed pocket	*Perognathus fasciatus*	UT	Mammal	BS
Mouse, pacific pocket	*Perognathus longimembris*	CA	Mammal	FE
Mouse, pale kangaroo	*Microdipodops pallidus*	NV	Mammal	BS
Mouse, Palm Springs little pocket	*Perognathus longimembris bangsi*	CA	Mammal	BS
Mouse, petaled	*Pannaria rubiginosa*	CA, OR	Plant	BS
Mouse, Preble's meadow jumping	*Zapus hudsonius preblei*	CO, WY	Mammal	FT
Mouse, rock pocket	*Chaetodipus intermedius*	UT	Mammal	BS

Common Name	Scientific Name	State[1]	Class	Status[2]
Mouse, Salt Marsh Harvest	*Reithrodontomys raviventris*	CA	Mammal	FE
Mouse, San Joaquin pocket	*Perognathus inornatus inornatus*	CA	Mammal	BS
Mouse, silky pocket	*Perognathus flavus*	UT	Mammal	BS
Mouse, southern grasshopper	*Onychomys torridus*	UT	Mammal	BS
Mouse, Tulare grasshopper	*Onychomys torridus tularensis*	CA	Mammal	BS
Mouse, white-eared pocket	*Perognathus alticola alticola*	CA	Mammal	BS
Mouse, yellow-eared pocket	*Perognathus xanthonotus*	CA	Mammal	BS
Mousetail	*Myosurus clavicaulis*	OR	Plant	BS
Mousetails, Sierra Valley	*Ivesia aperta*	CA, NV	Plant	BS
Mudwort, southern	*Limosella acaulis*	ID	Plant	BS
Muhly, marsh	*Muhlenbergia glomerata*	OR	Plant	BS
Mule ears, El Dorado	*Wyethia reticulata*	CA	Plant	BS
Murrelet, Kittlitz's	*Brachyramphus brevirostris*	AK	Bird	BS
Murrelet, marbled	*Brachyramphus marmoratus*	CA, OR	Bird	FT
Murrelet, Xantus's	*Synthliboramphus hypoleucus*	CA, OR	Bird	BS
Mushroom, cauliflower	*Sparassis crispa*	CA	Plant	BS
Mushroom, little brown	*Clitocybe subditopoda*	CA	Fungi	BS
Mushroom, little brown	*Mycena quinaultensis*	CA	Fungi	BS
Mushroom, little green	*Dermocybe humboldtensis*	CA, OR	Fungi	BS
Mushroom, little green	*Hydropus marginellus*	CA	Fungi	BS
Mushroom, orange coral	*Ramaria largentii*	CA, OR	Fungi	BS
Mushroom, pinkish coral	*Ramaria amyloidea*	CA, OR	Fungi	BS
Mushroom, pinkish coral	*Ramaria cyaneigranosa*	CA	Fungi	BS
Mushroom, yellow coral	*Ramaria aurantiisiccescens*	CA	Fungi	BS
Mussel, western ridged	*Gonidea angulata*	OR	Invertebrate	BS
Mustard, Penland alpine fen	*Eutrema penlandii*	CO	Plant	FT
Mustard, slender-petaled	*Thelypodium stenopetalum*	CA	Plant	FE
Myotis, Arizona	*Myotis occultus*	AZ	Mammal	BS
Myotis, California	*Myotis californicus*	NV	Mammal	BS
Myotis, cave	*Myotis velifer*	AZ, CA, NM, NV	Mammal	BS
Myotis, fringed	*Myotis thysanodes*	AZ, CA, CO, ID, MT, NM, NV, OR, UT, WY	Mammal	BS
Myotis, fringe-tailed	*Myotis thysanodes phasapensis*	MT	Mammal	BS
Myotis, Keen's	*Myotis keenii*	OR	Mammal	BS
Myotis, little brown	*Myotis lucifugus*	NV	Mammal	BS
Myotis, long-eared	*Myotis evotis*	AZ, CA, ID, NM, NV, MT, WY	Mammal	BS

Common Name	Scientific Name	State[1]	Class	Status[2]
Myotis, long-legged	*Myotis volans*	AZ, ID, MT, NM, NV	Mammal	BS
Myotis, northern	*Myotis septentrionalis*	MT	Mammal	BS
Myotis, western small-footed	*Myotis ciliolabrum*	AZ, CA, ID, NM, NV	Mammal	BS
Myotis, Yuma	*Myotis yumanensis*	CA, CO, ID, NM, NV	Mammal	BS
Nagoonberry	*Rubus acaulis*	OR	Plant	BS
Nama	*Nama densum*	MT	Plant	BS
Nannyberry	*Viburnum lentago*	MT	Plant	BS
Naucorid, Ash Meadows	*Ambrysus amargosus*	NV	Invertebrate	FT
Naucorid bug, Nevares Spring (=Furnace Creek)	*Ambrysus funebris*	CA	Invertebrate	C
Navarretia, Baker's	*Navarretia leucocephala* ssp. *bakeri*	CA	Plant	BS
Navarretia, few-flowered	*Navarretia leucocephala* ssp. *pauciflora*	CA	Plant	FE
Navarretia, many-flowered	*Navarretia leucocephala* ssp. *plieantha*	CA	Plant	FE
Navarretia, marigold	*Navarretia tagetina*	OR	Plant	BS
Navarretia, Piute Mountains	*Navarretia setiloba*	CA	Plant	BS
Navarretia, shining	*Navarretia nigelliformis*	CA	Plant	BS
Navarretia, spreading	*Navarretia fossalis*	CA	Plant	FT
Navarretia, white-flowered	*Navarretia leucocephala*	OR	Plant	BS
Necklacepod, western	*Sophora leachiana*	OR	Plant	BS
Needle, giant Spanish	*Palafoxia arida*	CA	Plant	BS
Needlegrass, desert	*Achnatherum speciosum*	OR	Plant	BS
Needlegrass, green	*Stipa viridula*	ID	Plant	BS
Nemacladus, slender	*Nemacladus capillaris*	OR	Plant	BS
Nemacladus, Twisselmann's	*Nemacladus twisselmannii*	CA	Plant	BS
Neoparrya, rock loving	*Neoparrya lithophila*	CO, OR	Plant	BS
Neststraw, Mason	*Stylocline masonii*	CA	Plant	BS
Neststraw, oil	*Stylocline citroleum*	CA	Plant	BS
Nighthawk, common	*Chordeiles minor*	OR	Bird	BS
Niterwort, Amargosa	*Nitrophila mohavensis*	CA, NV	Plant	FE
Nuthatch, pygmy	*Sitta pygmaea*	ID, OR	Bird	BS
Nuthatch, slender-billed	*Sitta carolinensis*	OR	Bird	BS
Nymph, Big Smoky wood	*Cercyonis oetus alkalorum*	NV	Invertebrate	BS
Nymph, Carson Valley wood	*Cercyonis pegala* ssp.	NV	Invertebrate	BS
Nymph, pallid wood	*Cercyonis oetus pallescens*	NV	Invertebrate	BS
Nymph, White River wood	*Cercyonis pegala carsonensis*	NV	Invertebrate	BS
Oak, bur	*Quercus macrocarpa*	MT	Plant	BS
Ocelot	*Leopardus pardalis*	AZ	Mammal	FE

Common Name	Scientific Name	State[1]	Class	Status[2]
Onion, Aase's	*Allium aaseae*	ID	Plant	BS
Onion, constricted Douglas	*Allium constrictum*	OR	Plant	BS
Onion, Geyer's	*Allium geyeri*	OR	Plant	BS
Onion, Hickman's	*Allium hickmanii*	CA	Plant	BS
Onion, Jepson's	*Allium jepsonii*	CA	Plant	BS
Onion, Munz's	*Allium munzii*	CA	Plant	FE
Onion, Parish wild	*Allium parishii*	AZ	Plant	BS
Onion, Rawhide Hill	*Allium tuolumnense*	CA	Plant	BS
Onion, Sierra	*Allium campanulatum*	OR	Plant	BS
Onion, Spanish needle	*Allium shevockii*	CA	Plant	BS
Onion, tall swamp	*Allium validum*	ID	Plant	BS
Onion, tapertip	*Allium acuminatum*	MT	Plant	BS
Onion, Tolmie's	*Allium tolmiei*	ID	Plant	BS
Onion, two-headed	*Allium anceps*	ID	Plant	BS
Orache, Earlimart	*Atriplex erecticaulis*	CA	Plant	BS
Orache, subtle	*Atriplex subtilis*	CA	Plant	BS
Orchid, chatterbox	*Epipactis gigantea*	ID	Plant	BS
Orchid, western prairie fringed	*Platanthera praeclara*	MT, WY	Plant	FT
Orchid, white-flowered rein	*Piperia candida*	CA	Plant	BS
Orcutt grass, California	*Orcuttia californica*	CA	Plant	FE
Orcutt grass, hairy	*Orcuttia pilosa*	CA	Plant	FE
Orcutt grass, Sacramento	*Orcuttia viscida*	CA	Plant	FE
Orcutt grass, San Joaquin Valley	*Orcuttia inaequalis*	CA	Plant	FT
Orcutt grass, slender	*Orcuttia tenuis*	CA	Plant	FT
Oregonian (snail), disc	*Cryptomastix* sp.	OR	Invertebrate	BS
Oregonian, Mission Creek	*Cryptomastrix magnidentata*	ID	Fish	BS
Oregonian, Puget	*Cryptomastix devia*	OR	Invertebrate	BS
Oriole, Scott's	*Icterus parisorum*	ID	Bird	BS
Orthocarpus, Shasta	*Orthocarpus pachystachyus*	CA	Plant	BS
Orthotrichium, halls	*Orthotrichium hallii*	ID	Plant	BS
Oryctes, nevada	*Oryctes nevadensis*	CA, NV	Plant	BS
Osprey	*Pandion haliaetus*	NV, UT	Bird	BS
Otter, northern river	*Lutra canadensis*	UT, WY	Mammal	BS
Otter, northern sea	*Enhydra lutris kenyoni*	AK	Mammal	FT
Otter, river	*Lutra canadensis*	AZ, ID, NM, NV, WY	Mammal	BS
Otter, sea	*Enhydra lutris*	OR	Mammal	BS
Otter, southern sea	*Enhydra lutris nereis*	CA	Mammal	FT/XN
Otter, southwestern	*Lutra canadensis sonora*	NM	Mammal	BS
Owl, boreal	*Aegolius funereus*	ID, MT	Bird	BS
Owl, burrowing	*Athene cunicularia*	CA, CO, MT, OR, UT, WY	Bird	BS

Common Name	Scientific Name	State[1]	Class	Status[2]
Owl, cactus ferruginous pygmy-	*Glaucidium brasilianum*	AZ	Bird	FE/BS
Owl, elf	*Micrathene whitneyi*	CA	Bird	BS
Owl, flammulated	*Otus flammeolus*	ID, MT, OR	Bird	BS
Owl, great gray	*Strix nebulosa*	ID, MT, NV, OR	Bird	BS
Owl, Mexican spotted	*Strix occidentalis lucida*	AZ, CA, CO, NM, UT	Bird	FT
Owl, northern (Blue Mtns.) pygmy	*Glaucidium gnoma*	OR	Bird	BS
Owl, northern spotted	*Strix occidentalis caurina*	CA, OR	Bird	FT
Owl, short-eared	*Asio flammeus*	AK, UT	Bird	BS
Owl, western burrowing	*Athene cunicularia*	AZ, ID, NV	Bird	BS
Owl, California spotted	*Strix occidentalis*	CA	Bird	BS
Owl-clover, rosy	*Orthocarpus bracteosus*	ID, OR	Plant	BS
Owl's-clover, fleshy	*Castilleja campestris* ssp. *succulenta*	CA	Plant	FT
Owl's-clover, Humboldt Bay	*Castilleja ambigua*	CA	Plant	BS
Owl's-clover, succulent	*Castilleja campestris*	CA, CO, UT	Plant	FT
Oxytheca, Cushenberry	*Oxytheca parishii* var. *goodmaniana*	CA, UT	Plant	FE
Paddlefish	*Polyodon spathula*	MT	Fish	BS
Paintbrush, annual Indian	*Castilleja exilis*	MT	Plant	BS
Paintbrush, aquarius	*Castilleja aquariensis*	UT	Plant	C
Paintbrush, ash-grey	*Castilleja cinerea*	CA	Plant	FT
Paintbrush, Chamber's	*Castilleja chambersii*	OR	Plant	BS
Paintbrush, Christ's	*Castilleja christii*	ID	Plant	C
Paintbrush, fraternal	*Castilleja fraterna*	OR	Plant	BS
Paintbrush, golden	*Castilleja levisecta*	OR	Plant	FT
Paintbrush, green-tinged	*Castilleja chlorotica*	OR	Plant	BS
Paintbrush, Mendocino Coast	*Castilleja mendocinensis*	CA, OR	Plant	BS
Paintbrush, Monte Neva	*Castilleja salsuginosa*	NV	Plant	BS
Paintbrush, Mount Gleason Indian	*Castilleja gleasonii*	CA	Plant	BS
Paintbrush, Obispo Indian	*Castilleja densiflora* ssp. *obospoensis*	CA	Plant	BS
Paintbrush, obscure Indian	*Castilleja cryptantha*	OR	Plant	BS
Paintbrush, ornate	*Castilleja ornata*	NM	Plant	BS
Paintbrush, purple alpine	*Castilleja rubida*	OR	Plant	BS
Paintbrush, soft-leaved	*Castilleja mollis*	CA	Plant	FE
Paintbrush, Steens Mountain	*Castilleja pilosa* var. *steenensis*	OR	Plant	BS
Paintbrush, Thompson's	*Castilleja thompsonii*	OR	Plant	BS
Paintbrush, Tiburon	*Castilleja affinis*	CA	Plant	FE
Paronychia, Ahart's	*Paronychia ahartii*	CA	Plant	BS

Common Name	Scientific Name	State[1]	Class	Status[2]
Pasqueflower	*Anemone nuttalliana*	OR	Plant	BS
Peaclam, montane	*Pisidium ultramontanum*	OR	Invertebrate	BS
Peavine, thin-leaved	*Lathyrus holochlorus*	OR	Plant	BS
Pebblesnail, Ash Meadows	*Pyrgulopsis erythropoma*	NV	Invertebrate	BS
Pebblesnail, casebeer	*Fluminicola* sp.	OR	Invertebrate	BS
Pebblesnail, Columbia	*Fluminicola columbianus*	ID	Invertebrate	BS
Pebblesnail, Donner und Blitzen	*Fluminicola insolitus*	OR	Invertebrate	BS
Pebblesnail, Fall Creek	*Fluminicola* sp.	OR	Invertebrate	BS
Pebblesnail, Keene Creek	*Fluminicola* sp.	OR	Invertebrate	BS
Pebblesnail, Klamath	*Fluminicola* sp.	OR	Invertebrate	BS
Pebblesnail, Klamath Rim	*Fluminicola* sp.	OR	Invertebrate	BS
Pebblesnail, Lake of the Woods	*Fluminicola* sp.	OR	Invertebrate	BS
Pebblesnail, Moapa	*Pyrgulopsis avernalis*	NV	Invertebrate	BS
Pebblesnail, Newrite	*Fluminicola* sp.	OR	Invertebrate	BS
Pebblesnail, Pahranagat	*Pyrgulopsis merriami*	NV	Invertebrate	BS
Pebblesnail, tigerlily	*Fluminicola* sp.	OR	Invertebrate	BS
Pebblesnail, toothed	*Fluminicola* sp.	OR	Invertebrate	BS
Pedicularis hirsuta	*Pedicularis hirsuta*	AK	Plant	BS
Pelican, American white	*Pelecanus erythrorhynchus*	CO, NV, OR, UT	Bird	BS
Pelican, brown	*Pelecanus occidentalis*	AK, AZ, CA, OR	Bird	BS
Pennycress, Kneeland Prairie	*Thlaspi californicum*	CA	Plant	FE
Pennycress, meadow	*Thlaspi parviflorum*	MT	Plant	BS
Pennyroyal, Todsen's	*Hedeoma todsenii*	NM	Plant	FE
Penstemon, blowout	*Penstemon haydenii*	WY	Plant	FE
Penstemon, Idaho	*Penstemon idahoensis*	CO, ID, NV	Plant	BS
Penstemon, Janish's	*Penstemon janishiae*	CA, ID	Plant	BS
Penstemon, Lemhi	*Penstemon lemhiensis*	ID, MT	Plant	BS
Penstemon, narrowleaf	*Penstemon angustifolius*	MT	Plant	BS
Penstemon, Peck's	*Penstemon peckii*	OR	Plant	BS
Penstemon, variable hot-rock	*Penstemon deustus*	OR	Plant	BS
Penstemon, Whited's	*Penstemon eriantherus*	OR	Plant	BS
Penstemon, white-margined	*Penstemon albomarginatus*	AZ, CA, NV	Plant	BS
Penstemon, Wilcox's	*Penstemon wilcoxii*	OR	Plant	BS
Pentachaeta, Lyons	*Pentachaeta lyonii*	CA	Plant	FE
Pentachaeta, slender	*Pentachaeta exilis*	CA	Plant	BS
Pentachaeta, white-rayed	*Pentachaeta bellidiflora*	CA	Plant	FE
Peppercress, Pueblo Valley	*Lepidium montanum*	NV	Plant	BS
Peppercress, Tiehm	*Stroganowia tiehmii*	NV	Plant	BS
Peppergrass, Borrego Valley	*Lepidium flavum*	CA	Plant	BS
Peppergrass, Davis'	*Lepidium davisii*	ID, OR	Plant	BS

Common Name	Scientific Name	State[1]	Class	Status[2]
Peppergrass, entire-leaved	*Lepidium integrifolium*	WY	Plant	BS
Peppergrass, Jared's	*Lepidium jaredii* ssp. *jaradii*	CA	Plant	BS
Peppergrass, Ostler's	*Lepidium ostleri*	UT	Plant	C
Peppergrass, Panoche	*Lepidium jaredii* ssp. *album*	CA	Plant	BS
Peppergrass, slickspot	*Lepidium papilliferum*	ID	Plant	FT
Phacelia	*Phacelia* sp.	CA	Plant	BS
Phacelia, Brand's	*Phacelia stellaris*	CA	Plant	C
Phacelia, Charlotte's	*Phacelia nashiana*	CA	Plant	BS
Phacelia, Clarke	*Phacelia filiae*	NV	Plant	BS
Phacelia, clay	*Phacelia argillacea*	UT	Plant	FE
Phacelia, Cooke's	*Phacelia cookei*	CA	Plant	BS
Phacelia, Death Valley round-leaved	*Phacelia mustelina*	CA, ID	Plant	BS
Phacelia, Debeque	*Phacelia submutica*	CO	Plant	FT
Phacelia, dwarf	*Phacelia tetramera*	OR	Plant	BS
Phacelia, Franklin's	*Phacelia franklinii*	OR	Plant	BS
Phacelia, hoary	*Phacelia incana*	MT	Plant	BS
Phacelia, Hot Spring	*Phacelia thermalis*	MT	Plant	BS
Phacelia, Inyo	*Phacelia inyoensis*	CA	Plant	BS
Phacelia, island	*Phacelia insularis*	CA	Plant	FE
Phacelia, least	*Phacelia minutissima*	ID, NV, OR	Plant	BS
Phacelia, Macbride	*Phacelia mollis*	AK	Plant	BS
Phacelia, Mackenzie's	*Phacelia lutea* var. *mackenzieorum*	OR	Plant	BS
Phacelia, Malheur yellow	*Phacelia lutea*	ID	Plant	BS
Phacelia, Mono County	*Phacelia monoensis*	CA, NV	Plant	BS
Phacelia, Mount Diablo	*Phacelia phacelioides*	CA	Plant	BS
Phacelia, naked-stemmed	*Phacelia gymnoclada*	OR	Plant	BS
Phacelia, Nine Mile Canyon	*Phacelia novenmillensis*	CA	Plant	BS
Phacelia, North Park	*Phacelia formosula*	CO	Plant	FE
Phacelia, obscure	*Phacelia inconspicua*	ID, NV	Plant	BS
Phacelia, Parish	*Phacelia parishii*	AZ, CA, NM, NV	Plant	BS
Phacelia, playa	*Phacelia inundata*	CA, NV, OR	Plant	BS
Phacelia, Scott Mountain	*Phacelia dalesiana*	CA	Plant	BS
Phacelia, Scott Valley	*Phacelia greenei*	CA	Plant	BS
Phacelia, silvery	*Phacelia argentea*	OR	Plant	BS
Phacelia, Siskiyou	*Phacelia leonis*	CA, OR	Plant	BS
Phacelia, Stebbin's	*Phacelia stebbinsii*	CA	Plant	BS
Phacelia, sticky	*Phacelia lenta*	OR	Plant	BS
Phaeocollybia, California	*Phaeocollybia californica*	CA, OR	Fungi	BS
Phaeocollybia, olive	*Phaeocollybia olivacea*	CA, OR	Fungi	BS
Phaeocollybia, spruce	*Phaeocollybia piceae*	CA	Fungi	BS

Common Name	Scientific Name	State[1]	Class	Status[2]
Phainopepla	*Phainopepla nitens*	NV, OR	Bird	BS
Phlox, Beaver Rim	*Phlox pungens*	WY	Plant	BS
Phlox, Hazel's prickly	*Leptodactylon pungens*	ID, OR	Plant	BS
Phlox, Henderson's	*Phlox hendersonii*	OR	Plant	BS
Phlox, Kelsey's	*Phlox kelseyi*	ID	Plant	BS
Phlox, many-flowered	*Phlox multiflora*	OR	Plant	BS
Phlox, mat prickly	*Leptodactylon caespitosum*	MT	Plant	BS
Phlox, Missoula	*Phlox missoulensis*	MT	Plant	BS
Phlox, Owyhee prickly	*Leptodactylon glabrum*	ID, NV	Plant	BS
Phlox, plains	*Phlox andicola*	MT	Plant	BS
Phlox, Yreka	*Phlox hirsuta*	CA	Plant	FE
Physa (snail), hot spring	*Physella* sp.	OR	Invertebrate	BS
Physa (snail), rotund	*Physella columbiana*	OR	Invertebrate	BS
Pika, American	*Ochotona princeps*	NV, UT	Mammal	BS
Pikeminnow, Colorado	*Ptychocheilus lucius*	AZ, CA, CO, NM, UT, WY	Fish	FE/XN
Pillwort, American	*Pilularia americana*	OR	Plant	BS
Pilot, Mason's sky	*Polemonium chartaceum*	CA	Plant	BS
Pincushion cactus, Brady	*Pediocactus bradyi*	AZ	Plant	FE
Pincushion cactus, Cochise	*Coryphantha robbinsorum*	AZ	Plant	FT
Pincushion cactus, Kaibab	*Pediocactus paradinei*	AZ	Plant	BS
Pincushion cactus, Lee	*Coryphantha sneedii* var. *leei*	NM	Plant	FT
Pincushion cactus, Siler	*Pediocactus sileri*	AZ, UT	Plant	FT
Pincushion cactus, Sneed	*Coryphantha sneedii* var. *sneedii*	NM	Plant	FE
Pincushion cactus, Villard's	*Escobaria villardii*	CA, NM	Plant	BS
Pincushion, Blaine	*Sclerocactus blainei*	NV	Plant	BS
Pincushion, desert	*Chaenactis stevioides*	ID	Plant	BS
Pincushion, Schlesser	*Sclerocactus schlesseri*	NV	Plant	BS
Pincushion, Tonopah	*Sclerocactus nyensis*	NV	Plant	BS
Pine, limber	*Pinus flexilis*	WY	Plant	BS
Pine, Washoe	*Pinus ponderosa* var. *washoensis*	NV	Plant	BS
Pine, whitebark	*Pinus albicaulis*	NV, WY	Plant	BS
Piperia, Yadon's	*Piperia yadonii*	CA	Plant	FE
Pipistrelle, western	*Pipistrellus hesperus*	NV	Mammal	BS
Pipit, Sprague's	*Anthus spragueii*	AZ, CO, MT, NM	Bird	BS
Pitcher-sage, Gander's	*Lepechinia ganderi*	CA	Plant	BS
Plagiobothrys, Austin's	*Plagiobothrys austiniae*	OR	Plant	BS
Plant, Death Valley sandpaper	*Petalonyx thurberi*	CA	Plant	BS
Plant, Dolores skeleton	*Lygodesmia doloresensis*	CO	Plant	BS
Plant, white-margined wax	*Glyptopleura marginata*	ID	Plant	BS

Common Name	Scientific Name	State[1]	Class	Status[2]
Plover, mountain	*Charadrius montanus*	AZ, CA, CO, MT, NM, NV, UT, WY	Bird	FP/BS
Plover, piping	*Charadrius melodus*	CO, MT, NM, WY	Bird	FT
Plover, snowy	*Charadrius alexandrinus*	CO, UT	Bird	BS
Plover, western snowy	*Charadrius nivosus nivosus*	CA, OR	Bird	FT
Pogogyne, profuse-flowered	*Pogogyne floribunda*	CA, OR	Plant	BS
Polemonium, great	*Polemonium carneum*	OR	Plant	BS
Polemonium, skunk	*Polemonium viscosum*	OR	Plant	BS
Polemonium, Washington	*Polemonium pectinatum*	OR	Plant	BS
Polygonum, Scott's Valley	*Polygonum hickmanii*	CA	Plant	FE
Polypore, blue-capped	*Albatrellus flettii*	CA	Plant	BS
Polypore, blue-pored	*Albatrellus caeruleoporus*	CA	Plant	BS
Pondweed, Rafinesque's	*Potamogeton diversifolius*	OR	Plant	BS
Poolfish, Pahrump	*Empetrichthys latos*	NV	Fish	FE
Popcornflower, altered andesite	*Plagiobothrys glomeratus*	NV	Plant	BS
Popcornflower, Greene's	*Plagiobothrys greenei*	OR	Plant	BS
Popcornflower, hooked	*Plagiobothrys uncinatus*	CA	Plant	BS
Popcornflower, rough	*Plagiobothrys hirtus*	OR	Plant	FE
Popcornflower, shiny-fruited	*Plagiobothrys lamprocarpus*	OR	Plant	BS
Popcornflower, slender-branched	*Plagiobothrys leptocladus*	MT	Plant	BS
Poppy, arctic	*Papaver gorodkovii*	AK	Plant	BS
Poppy, diamond-petaled California	*Eschscholzia rhombipetala*	CA	Plant	BS
Poppy, gold	*Eschscholzia caespitosa*	OR	Plant	BS
Poppy, pale	*Papaver alboroseum*	AK	Plant	BS
Poppy, red rock	*Eschscholzia minutiflora*	CA	Plant	BS
Poppy, walpole	*Papaver walpolei*	AK	Plant	BS
Potentilla, Hickman's	*Potentilla hickmanii*	CA	Plant	FE
Prairie dog, Arizona black-tailed	*Cynomys ludovicianus arizonensis*	AZ, NM	Mammal	BS
Prairie dog, black-tailed	*Cynomys ludovicianus*	AZ, CO, ID, MT, NM, WY	Mammal	C
Prairie dog, Gunnison's	*Cynomys gunnisoni*	AZ, CO, UT	Mammal	C
Prairie dog, Utah	*Cynomys parvidens*	UT	Mammal	FT
Prairie dog, white-tailed	*Cynomys leucurus*	CO, MT, UT, WY	Mammal	BS
Prairie-chicken, lesser	*Tympanuchus pallidicinctus*	CO, NM	Bird	FT
Prickly poppy	*Argemone munita*	OR	Plant	BS
Prickly poppy, Sacramento	*Argemone pleiacantha*	NM	Plant	FE
Primrose, alkali	*Primula alcalina*	ID, MT	Plant	BS
Primrose, arctic dwarf	*Douglasia beringensis*	AK	Plant	BS

Common Name	Scientific Name	State[1]	Class	Status[2]
Primrose, Chukchi	*Primula tschuktschorum*	AK	Plant	BS
Primrose, Greenland	*Primula egaliksensis*	CO	Plant	BS
Primrose, Maguire	*Primula maguirei*	UT	Plant	FT
Primrose, mealy	*Primula incana*	MT	Plant	BS
Pronghorn, Sonoran	*Antilocapra americana sonoriensis*	AZ	Mammal	FE/XN
Pseudoscorpion, Malheur	*Apochthonius malheuri*	OR	Invertebrate	BS
Puffin, tufted	*Fratercula cirrhata*	OR	Bird	BS
Pupfish, Amargosa	*Cyprinodon nevadensis*	CA	Fish	BS
Pupfish, Ash Meadows Amargosa	*Cyprinodon nevadensis mionectes*	NV	Fish	FE
Pupfish, desert	*Cyprinodon macularius*	AZ, CA	Fish	FE
Pupfish, Devil's Hole	*Cyprinodon diabolis*	NV	Fish	FE
Pupfish, Owens	*Cyprinodon radiosus*	CA	Fish	FE
Pupfish, Warm Springs	*Cyprinodon nevadensis pectoralis*	NV	Fish	FE
Purpusia, rock	*Ivesia arizonica*	NV	Plant	BS
Pussypaws	*Cistanthe* sp.	CA	Plant	BS
Pussypaws, Mariposa	*Calyptridium pulchellum*	CA	Plant	FT
Pussypaws, rosy	*Calyptridium roseum*	OR	Plant	BS
Pussypaws, Santa Cruz Mountains	*Calyptridium parryi* var. *hessiae*	CA	Plant	BS
Pussytoes, dense-leaved	*Antennaria densifolia*	AK	Plant	BS
Pussytoes, meadow	*Antennaria arcuata*	ID, NV, WY	Plant	BS
Pussytoes, flat-top	*Antennaria corymbosa*	OR	Plant	BS
Pussytoes, Nuttall's	*Antennaria parvifolia*	OR	Plant	BS
Pygmyleaf, sagebrush	*Loeflingia squarrosa*	NV	Plant	BS
Pyrg, bifid duct	*Pyrgulopsis peculiaris*	NV	Invertebrate	BS
Pyrg, carinate duckwater	*Pyrgulopsis carinata*	NV	Invertebrate	BS
Pyrg, Dixie Valley	*Pyrgulopsis dixensis*	NV	Invertebrate	BS
Pyrg, Duckwater	*Pyrgulopsis aloba*	NV	Invertebrate	BS
Pyrg, Duckwater Warm Springs	*Pyrgulopsis villacampae*	NV	Invertebrate	BS
Pyrg, elongate Cain Spring	*Pyrgulopsis augusta*	NV	Invertebrate	BS
Pyrg, flat-topped steptoe	*Pyrgulopsis planulata*	NV	Invertebrate	BS
Pyrg, Humboldt	*Pyrgulopsis homboldtensis*	NV	Invertebrate	BS
Pyrg, Landye's	*Pyrgulopsis landyei*	NV	Invertebrate	BS
Pyrg, large-gland carico	*Pyrgulopsis basiglans*	NV	Invertebrate	BS
Pyrg, median gland Nevada	*Pyrgulopsis pisteri*	NV	Invertebrate	BS
Pyrg, Moapa Valley	*Pyrgulopsis carinifera*	NV	Invertebrate	BS
Pyrg, northern Soldier Meadow	*Pyrgulopsis militaris*	NV	Invertebrate	BS
Pyrg, Oasis Valley	*Pyrgulopsis micrococcus*	NV	Invertebrate	BS
Pyrg, ovate Cain Spring	*Pyrgulopsis pictilis*	NV	Invertebrate	BS
Pyrg, southeast Nevada	*Pyrgulopsis turbatrix*	NV	Invertebrate	BS

Common Name	Scientific Name	State[1]	Class	Status[2]
Pyrg, southern Duckwater	*Pyrgulopsis anatina*	NV	Invertebrate	BS
Pyrg, southern Soldier Meadow	*Pyrgulopsis umbilicata*	NV	Invertebrate	BS
Pyrg, southern steptoe	*Pyrgulopsis sulcata*	NV	Invertebrate	BS
Pyrg, Spring Mountains	*Pyrgulopsis deaconi*	NV	Invertebrate	BS
Pyrg, Squat Mud Meadows	*Pyrgulopsis limaria*	NV	Invertebrate	BS
Pyrg, sub-globose Steptoe Ranch	*Pyrgulopsis orbiculata*	NV	Invertebrate	BS
Pyrg, tranverse gland	*Pyrgulopsis cruciglans*	NV	Invertebrate	BS
Pyrg, vinyards	*Pyrgulopsis vinyardi*	NV	Invertebrate	BS
Pyrg, Wong's	*Pyrgulopsis wongi*	NV	Invertebrate	BS
Pyrrocoma, racemose	*Pyrrocoma racemosa*	OR	Plant	BS
Pyrrocoma, sticky	*Pyrrocoma lucida*	CA	Plant	BS
Quail, mountain	*Oreortyx pictus*	OR	Bird	BS
Queen-of-the-forest	*Filipendula occidentalis*	OR, WY	Plant	BS
Quillwort, Nuttall's	*Isoetes nuttallii*	OR	Plant	BS
Rabbit, pygmy	*Brachylagus idahoensis*	CA, ID, MT, NV, OR, UT, WY	Mammal	BS, FE
Rabbit, riparian brush	*Sylvilagus bachmani*	CA	Mammal	FE
Rabbitbrush, centennial	*Chrysothamnus parryi*	ID	Plant	BS
Rabbitbrush, Guadalupe	*Chrysothamnus nauseosus*	NM	Plant	BS
Ragwort, cut-leaved	*Packera eurycephala*	CA	Plant	BS
Ragwort, few flowered	*Packera pauciflora*	CO	Plant	BS
Ragwort, red hills	*Packera clevelandii*	CA	Plant	BS
Ragwort, western	*Packera hesperia*	OR	Plant	BS
Rail, California black	*Laterallus jamaicensis*	AZ, CA	Bird	BS
Rail, California clapper	*Rallus longirostris obsoletus*	CA	Bird	FE
Rail, light-footed clapper	*Rallus longirostris levipes*	CA	Bird	FE
Rail, Virginia	*Rallus limicola*	OR	Bird	BS
Rail, yellow	*Coturnicops noveboracensis*	OR, MT	Bird	BS
Rail, Yuma clapper	*Rallus longirostris yumanensis*	AZ, CA, NV	Bird	FE
Raillardella, Muir's	*Carlquistia muirii*	CA	Plant	BS
Raillardella, showy	*Raillardella pringlei*	CA	Plant	BS
Ramalina, dusty	*Ramalina pollinaria*	CA, OR	Plant	BS
Ramshorn, Borax Lake	*Planorbella oregonensis*	NM	Invertebrate	BS
Ramshorn, Great Basin	*Helisoma newberryi*	OR	Invertebrate	BS
Rasberry, northwest	*Rubus nigerrimus*	OR	Plant	BS
Rattlesnake, midget faded	*Crotalus viridis*	CO, WY	Reptile	BS
Rattlesnake, Mojave	*Crotalus scutulatus*	UT	Reptile	BS
Rattlesnake, New Mexican ridge-nosed	*Crotalus willardi obscurus*	AZ, NM	Reptile	FT
Rattlesnake, southwestern speckled	*Crotalus mitchellii pyrrhus*	UT	Reptile	BS

Common Name	Scientific Name	State[1]	Class	Status[2]
Rattlesnake, speckled	*Crotalus mitchellii mitchellii*	UT	Reptile	BS
Red knot	*Calidris canutus*	AK	Bird	BS
Redberry	*Rhamnus ilicifolia*	OR	Plant	BS
Reedgrass, Brewer's	*Calamagrostis breweri*	OR	Plant	BS
Reedgrass, Cascade	*Calamagrostis tweedyi*	ID	Plant	BS
Reedgrass, leafy	*Calamagrostis foliosa*	CA	Plant	BS
Reed-mustard, Barneby	*Schoenocrambe barnebyi*	ID, UT	Plant	FE
Reed-mustard, clay	*Schoenocrambe argillacea*	NM, UT	Plant	FT
Reed-mustard, shrubby	*Schoenocrambe suffrutescens*	CA, UT	Plant	FE
Ricegrass, little	*Oryzopsis exigua*	CA	Plant	BS
Ricegrass, small-flowered	*Oryzopsis micranthum*	ID	Plant	BS
Ricegrass, Wallowa	*Achnatherum wallowensis*	OR	Plant	BS
Ridge-cress, Barneby	*Lepidium barnebyanum*	UT	Plant	FE
Riffle beetle, Stephan's	*Heterelmis stephani*	AZ	Invertebrate	C
Ringstem, sticky	*Anulocaulis leiosolenus*	NV	Plant	BS
Ringtail	*Bassariscus astutus*	NM, UT	Mammal	BS
Roach, pit	*Lavinia symmetricus mitrulus*	OR	Fish	BS
Roach, Red Hills	*Lavinia symmetricus* ssp.	CA	Fish	BS
Rockbrake, Steller's	*Cryptogramma stelleri*	CO, OR	Plant	BS
Rockcress, Bodie Hills	*Boechera bodiensis*	NV	Plant	BS
Rockcress, Crandall	*Arabis crandallii*	CO	Plant	BS
Rockcress, Crater Lake	*Arabis suffrutescens*	CA, OR	Plant	BS
Rockcress, cross-haired	*Arabis crucisetosa*	OR	Plant	BS
Rockcress, Daggett	*Arabis demissa*	MT	Plant	BS
Rockcress, Darwin	*Arabis pulchra*	CA	Plant	BS
Rockcress, Elko	*Boechera falcifructa*	NV	Plant	BS
Rockcress, Fremont County	*Boechera pusilla*	WY	Plant	C
Rockcress, Hoffmann's	*Arabis hoffmannii*	CA	Plant	FE
Rockcress, Koehler's	*Arabis koehleri*	OR	Plant	BS
Rockcress, low northern	*Braya humilis*	MT	Plant	BS
Rock-ress, McDonald's	*Arabis macdonaldiana*	CA, OR	Plant	FE
Rockcress, park	*Arabis fernaldiana*	CO	Plant	BS
Rockcress, Santa Cruz Island	*Sibara filifolia*	CA	Plant	FE
Rockcress, sapphire	*Arabis fecunda*	MT	Plant	BS
Rockcress, sickle-pod	*Arabis sparsiflora*	OR	Plant	BS
Rockcress, small	*Arabis pusilla*	WY	Plant	BS
Rock-daisy, black	*Townsendia smithii*	AZ	Plant	BS
Rock-daisy, Clifton	*Perityle ambrosiifolia*	AZ	Plant	BS
Rock-daisy, nodding	*Perityle cernua*	NM, WY	Plant	BS
Rock-jasmine, Alaska	*Douglasia alaskana*	AK	Plant	BS
Rockmat, Chelan	*Petrophyton cinerascens*	OR	Plant	BS
Rock-rose, Mount Diablo	*Helianthella castanea*	CA	Plant	BS

Common Name	Scientific Name	State[1]	Class	Status[2]
Rose, Grand Canyon	*Rosa stellata*	AZ	Plant	BS
Rosewood, Arizona Sonoran	*Vauquelinia californica* ssp. *californica*	AZ	Plant	BS
Rosewood, limestone	*Vauquelinia californica* ssp. *pauciflora*	NM	Plant	BS
Rosy-finch, black	*Leucosticte atrata*	NV, OR	Bird	BS
Sorrel, grassleaf	*Rumex graminifolius*	AK	Plant	BS
Rupertia, Hall's	*Rupertia hallii*	CA	Plant	BS
Rush, Howell's	*Juncus howellii*	OR	Plant	BS
Rush, Kellog's	*Juncus kelloggii*	OR	Plant	BS
Rush, Red Bluff dwarf	*Juncus leiospermus*	CA	Plant	BS
Rush, three-flowered	*Juncus triglumis*	OR	Plant	BS
Rush, Tiehm's	*Juncus tiehmii*	OR	Plant	BS
Rush, twelfth	*Juncus uncialis*	OR	Plant	BS
Rush-lily, large-flowered	*Hastingsia bracteosa*	OR	Plant	BS
Rush-lily, purple-flowered	*Hastingsia bracteosa* var. *atropurpurea*	OR	Plant	BS
Rush-rose, island	*Helianthemum greenei*	CA	Plant	FT
Sabine-grass	*Pleuropogon sabinei*	AK	Plant	BS
Sage, American wood	*Teucrium canadense*	ID	Plant	BS
Sage, aravaipa	*Salvia amissa*	AZ	Plant	BS
Sage, arctic	*Artemisia senjavinensis*	AK	Plant	BS
Sage, chicken	*Sphaeromeria argentea*	MT	Plant	BS
Sage, Death Valley	*Salvia funerea*	NV	Plant	BS
Sage, Orocopia	*Salvia greatae*	CA	Plant	BS
Sagebrush, Lahontan	*Artemisia arbuscula* ssp. *longicaulis*	OR	Plant	BS
Sagebrush, Laramie false	*Sphaeromeria simplex*	WY	Plant	BS
Sagebrush, Owyhee	*Artemisia papposa*	OR	Plant	BS
Sagebrush, Porter's	*Artemisia porteri*	WY	Plant	BS
Sage-grouse, greater	*Centrocercus urophasianus*	CA, CO, ID, MT, NV, OR, UT, WY	Bird	PT
Sage-grouse, Gunnison	*Centrocercus minimus*	CO, UT	Bird	PE
Sagewort, coastal	*Artemisia pycnocephala*	OR	Plant	BS
Salamander, black	*Aneides flavipunctatus*	OR	Amphibian	BS
Salamander, California slender	*Batrachoseps attenuatus*	OR	Amphibian	BS
Salamander, California tiger	*Ambystoma californiense*	CA	Amphibian	FE/FT
Salamander, Cascade torrent	*Rhyacotriton cascadae*	OR	Amphibian	BS
Salamander, Coeur D'Alene	*Plethodon idahoensis*	ID, MT	Amphibian	BS
Salamander, Columbia torrent	*Rhyacotriton kezeri*	OR	Amphibian	BS
Salamander, Cope's giant	*Dicamptodon copei*	OR	Amphibian	BS
Salamander, desert slender	*Batrachoseps aridus*	CA	Amphibian	FE

Common Name	Scientific Name	State[1]	Class	Status[2]
Salamander, Inyo Mountains slender	*Batrachoseps campi*	CA	Amphibian	BS
Salamander, Jemez Mountains	*Plethodon neomexicanus*	NM	Amphibian	C
Salamander, Larch Mountain	*Plethodon larselli*	OR	Amphibian	BS
Salamander, limestone	*Hydromantes brunus*	CA	Amphibian	BS
Salamander, Olympic torrent	*Rhyacotriton olympicus*	OR	Amphibian	BS
Salamander, Oregon slender	*Batrachoseps wrighti*	OR	Amphibian	BS
Salamander, Santa Cruz long-toed	*Ambystoma macrodactylum*	CA	Amphibian	FE
Salamander, Shasta	*Hydromantes shastae*	CA	Amphibian	BS
Salamander, Siskiyou Mountains	*Plethodon stormi*	OR	Amphibian	BS
Salamander, Sonora tiger	*Ambystoma tigrinum stebbinsi*	AZ	Amphibian	FE
Salamander, Tehachapi slender	*Batrachoseps stebbinsi*	CA	Amphibian	BS
Salamander, Van Dyke's	*Plethodon vandykei*	OR	Amphibian	BS
Salamander, yellow-blotched	*Ensatina eschscholtzi*	CA	Amphibian	BS
Sallfly, Alaska	*Alaskaperla ovibovis*	AK	Invertebrate	BS
Salmon, Chinook (California Coastal ESU[3])	*Oncorhynchus tshawytscha*	CA	Fish	FT
Salmon, Chinook (Central Valley Spring-run ESU)	*Oncorhynchus tshawytscha*	CA	Fish	FT
Salmon, Chinook (Lower Columbia River ESU)	*Oncorhynchus tshawytscha*	OR	Fish	FT
Salmon, Chinook (Sacramento River Winter-run ESU)	*Oncorhynchus tshawytscha*	CA, OR	Fish	FE
Salmon, Chinook (Snake River Fall-run ESU)	*Oncorhynchus tshawytscha*	ID, OR	Fish	FT
Salmon, Chinook (Snake River Spring/Summer-run ESU)	*Oncorhynchus tshawytscha*	ID, OR	Fish	FT
Salmon, Chinook (Upper Columbia River Spring-run ESU)	*Oncorhynchus tshawytscha*	OR	Fish	FE
Salmon, Chinook (Upper Willamette River ESU)	*Oncorhynchus tshawytscha*	OR	Fish	FT
Salmon, chum (California Coastal ESU)	*Oncorhynchus keta*	OR	Fish	BS
Salmon, chum (Columbia River ESU)	*Oncorhynchus keta*	OR	Fish	FT
Salmon, chum (Hood Canal Summer-run ESU)	*Oncorhynchus keta*	OR	Fish	FT
Salmon, coho (Central California Coast ESU)	*Oncorhynchus kisutch*	CA, OR	Fish	FE
Salmon, coho (Lower Columbia River ESU)	*Oncorhynchus kisutch*	OR	Fish	FT

Common Name	Scientific Name	State[1]	Class	Status[2]
Salmon, coho (Oregon Coast ESU)	*Oncorhynchus kisutch*	OR	Fish	FT
Salmon, coho (Southern Oregon/Northern California ESU)	*Oncorhynchus kisutch*	CA, OR	Fish	FT
Salmon, fall Chinook	*Oncorhynchus tshawytscha*	OR	Fish	BS
Salmon, sockeye (Snake River, Idaho ESU)	*Oncorhynchus nerka*	ID, OR	Fish	FE
Saltbush, Griffith's	*Atriplex griffithsii*	NM	Plant	BS
Saltbush, heart-leaved	*Atriplex cordulata*	CA	Plant	BS
Saltbush, Lost Hills	*Atriplex vallicola*	CA	Plant	BS
Sandfood	*Pholisma sonorae*	AZ, CA	Plant	BS
Sandfood, scaly	*Pholisma arenaria*	AZ	Plant	BS
Sandpiper, Bering Sea rock	*Calidris ptilocnemis*	AK	Bird	BS
Sandpiper, upland	*Bartramia longicauda*	ID, OR	Bird	BS
Sand-verbena, chaparral	*Abronia umbellata* var. *aurita*	CA	Plant	BS
Sand-verbena, pink	*Abronia umbellata* var. *brevifolia*	CA, OR	Plant	BS
Sand-verbena, Ramshaw Meadows	*Abronia alpina*	CA	Plant	C
Sandwort, Bear Valley	*Arenaria ursina*	CA	Plant	FT
Sandwort, Howell's	*Minuartia howellii*	CA	Plant	BS
Sandwort, Lassic's	*Minuartia decumbens*	CA	Plant	BS
Sandwort, marsh	*Arenaria paludicola*	CA, OR	Plant	FE
Sandwort, Nuttall's	*Minuartia nuttallii*	CO	Plant	BS
Sandwort, Scott Mountain	*Minuartia stolonifera*	CA	Plant	BS
Sanicle, rock	*Sanicula saxatilis*	CA	Plant	BS
Sanicle, Tracy's	*Sanicula tracyi*	CA	Plant	BS
Saniclef, Sierra	*Sanicula graveolens*	ID	Plant	BS
Sapsucker, red-naped	*Sphyrapicus nuchalis*	ID	Bird	BS
Sapsucker, Williamson's	*Sphyrapicus thryoideus*	ID	Bird	BS
Sauger	*Stizostedion canadense*	MT	Fish	BS
Saw-wort, Weber	*Saussurea weberi*	CO	Plant	BS
Saxifrage, joint-leaved	*Saxifragopsis fragarioides*	OR	Plant	BS
Saxifrage, nodding	*Saxifraga cernua*	OR	Plant	BS
Saxifrage, wedge-leaf	*Saxifraga adscendens*	OR	Plant	BS
Scalebroom, gypsum	*Lepidospartum burgessii*	NM	Plant	BS
Scarab, aegialian	*Aegialia knighti*	NV	Invertebrate	BS
Scarab, big dune aphodius	*Aphodius* sp.	NV	Invertebrate	BS
Scarab, Ciervo aegialian	*Aegialia concinna*	CA	Invertebrate	BS
Scarab, Crescent Dunes aegialian	*Aegialia crescenta*	NV	Invertebrate	BS
Scarab, Crescent Dunes aphodius	*Aphodius* sp.	NV	Invertebrate	BS
Scarab, Crescent Dunes serican	*Serica ammoomenisco*	NV	Invertebrate	BS

Common Name	Scientific Name	State[1]	Class	Status[2]
Scarab, Guiliani's dune	*Pseudocotalpa guilianii*	NV	Invertebrate	BS
Scarab, Hardy's aegialian	*Aegialia hardyi*	NV	Invertebrate	BS
Scarab, Humboldt serican	*Serica humboldti*	NV	Invertebrate	BS
Scarab, large aegialian	*Aegialia magnifica*	NV	Invertebrate	BS
Scarab, Sand Mountain aphodius	*Aphodius* sp.	NV	Invertebrate	BS
Scarab, Sand Mountain serican	*Serica psamnobunus*	NV	Invertebrate	BS
Scarlet-gilia, Weber's	*Ipomopsis aggregate*	WY	Plant	BS
Scheuchzeria	*Scheuchzeria palustris*	OR	Plant	BS
Scorpionflower, Beatley	*Phacelia beatleyae*	NV	Plant	BS
Sculpin, Malheur mottled	*Cottus bendirei*	OR	Fish	BS
Sculpin, margined	*Cottus marginatus*	OR	Fish	BS
Sculpin, pit	*Cottus pitensis*	OR	Fish	BS
Sculpin, rough	*Cottus asperrimus*	CA	Fish	BS
Sculpin, Shoshone	*Cottus greenei*	ID	Fish	BS
Sculpin, Wood River	*Cottus leiopomus*	ID	Fish	BS
Scurfpea, three-nerved	*Pediomelum trinervatum*	AZ	Plant	BS
Sea turtle, green	*Chelonia mydas*	CA, OR	Reptile	FT
Sea turtle, leatherback	*Dermochelys coriacea*	AK, CA, OR	Reptile	FE
Sea turtle, loggerhead	*Caretta caretta*	CA, OR	Reptile	FT
Sea turtle, Olive Ridley	*Lepidochelys olivacea*	CA	Reptile	FT
Seablite, California	*Suaeda californica*	CA	Plant	FE
Seal, Guadalupe fur	*Arctocephalus townsendi*	CA	Mammal	FT
Sea-lion, Steller	*Eumetopias jubatus*	AK, CA, OR	Mammal	FT/FE
Sea-purslane, verrucose	*Sesuvium verrucosum*	OR	Plant	BS
Sedge, abrupt-beaked	*Carex abrupta*	OR	Plant	BS
Sedge, Alaskan single-spiked	*Carex scirpoidea*	OR	Plant	BS
Sedge, beaked	*Carex rostrata*	OR	Plant	BS
Sedge, blackened	*Carex atrosquama*	OR	Plant	BS
Sedge, blunt	*Carex obtusata*	OR	Plant	BS
Sedge, bristly	*Carex comosa*	ID, OR	Plant	BS
Sedge, Buxbaum's	*Carex buxbaumii*	ID	Plant	BS
Sedge, Canadian single-spike	*Carex scirpoidea* ssp. *scirpoidea*	CO, OR	Plant	BS
Sedge, capitate	*Carex capitata*	OR	Plant	BS
Sedge, circumpolar	*Carex adelostoma*	AK	Plant	BS
Sedge, coiled	*Carex circinata*	OR	Plant	BS
Sedge, Constance's	*Carex constanceana*	OR	Plant	BS
Sedge, Cordilleran	*Carex cordillerana*	OR	Plant	BS
Sedge, Crawford's	*Carex crawfordii*	OR	Plant	BS
Sedge, Craw's	*Carex crawei*	MT	Plant	BS
Sedge, dark alpine	*Carex subnigricans*	OR	Plant	BS
Sedge, few-flowered	*Carex pauciflora*	OR	Plant	BS

Common Name	Scientific Name	State[1]	Class	Status[2]
Sedge, foothill	*Carex tumulicola*	ID	Plant	BS
Sedge, giant	*Carex spissa*	AZ	Plant	BS
Sedge, green	*Carex viridula*	CO	Plant	BS
Sedge, hairlike	*Carex capillaris*	OR	Plant	BS
Sedge, hairy	*Carex gynodynama*	OR	Plant	BS
Sedge, Idaho	*Carex idahoa*	ID, MT, OR	Plant	BS
Sedge, Indian Valley	*Carex arboriginum*	ID	Plant	BS
Sedge, intermediate	*Carex media*	OR	Plant	BS
Sedge, Klamath	*Carex klamathensis*	CA, OR	Plant	BS
Sedge, large-awn	*Carex macrochaeta*	OR	Plant	BS
Sedge, lesser panicled	*Carex diandra*	OR	Plant	BS
Sedge, long-styled	*Carex stylosa*	OR	Plant	BS
Sedge, low northern	*Carex concinna*	CO	Plant	BS
Sedge, many-headed	*Carex sychnocephala*	OR	Plant	BS
Sedge, Mount Shasta	*Carex straminiformis*	ID	Plant	BS
Sedge, native	*Carex vernacula*	OR	Plant	BS
Sedge, Navajo	*Carex specuicola*	AZ, UT	Plant	FT
Sedge, new	*Carex pelocarpa*	OR	Plant	BS
Sedge, pale	*Carex livida*	CO, ID, OR	Plant	BS
Sedge, Parry's	*Carex parryana*	ID	Plant	BS
Sedge, poor	*Carex magellanica*	OR	Plant	BS
Sedge, Pyrenaean	*Carex pyrenaica*	OR	Plant	BS
Sedge, retrorse	*Carex retrorsa*	OR	Plant	BS
Sedge, San Luis Obispo	*Carex obispoensis*	CA	Plant	BS
Sedge, saw-tooth	*Carex serratodens*	OR	Plant	BS
Sedge, short stemmed	*Carex brevicaulis*	OR	Plant	BS
Sedge, Sierra nerved	*Carex nervina*	OR	Plant	BS
Sedge, simple bog	*Kobresia simpliciuscula*	MT, OR	Plant	BS
Sedge, Siskiyou	*Carex scabriuscula*	OR	Plant	BS
Sedge, slender	*Carex lasiocarpa*	OR	Plant	BS
Sedge, small-winged	*Carex stenoptila*	MT	Plant	BS
Sedge, Smokey Mountain	*Carex proposita*	OR	Plant	BS
Sedge, sparse-leaved	*Carex tenuiflora*	OR	Plant	BS
Sedge, spikenard	*Carex nardina*	OR	Plant	BS
Sedge, string-root	*Carex chordorrhiza*	ID, OR	Plant	BS
Sedge, valley	*Carex vallicola*	OR	Plant	BS
Sedge, western	*Carex occidentalis*	ID	Plant	BS
Sedge, white	*Carex albida*	CA	Plant	FE
Sedge, yellow	*Carex flava*	CO	Plant	BS
Sedge, yellow bog	*Carex dioica*	OR	Plant	BS
Sedge, yellow-flowered	*Carex anthoxanthea*	OR	Plant	BS
Semaphoregrass, Oregon	*Pleuropogon oregonus*	OR	Plant	BS

Common Name	Scientific Name	State[1]	Class	Status[2]
Senecio, Ertter's	*Senecio ertterae*	OR	Plant	BS
Sheep, bighorn	*Ovis canadensis*	NV	Mammal	BS
Sheep, California bighorn	*Ovis canadensis californiana*	ID	Mammal	BS
Sheep, desert bighorn	*Ovis canadensis mexicana*	CA, CO	Mammal	BS
Sheep, peninsular bighorn	*Ovis canadensis nelsoni*	CA	Mammal	FE
Sheep, Sierra Nevada bighorn	*Ovis canadensis sierrae*	CA	Mammal	FE
Shield-fern, crested	*Dryopteris cristata*	OR	Plant	BS
Shiner, Arkansas River	*Notropis girardi*	NM	Fish	FT
Shiner, beautiful	*Cyprinella formosa*	AZ, NM	Fish	FT
Shiner, Lahontan redside	*Richardsonius egregius*	OR	Fish	BS
Shiner, Pecos bluntnose	*Notropis simus pecosensis*	NM	Fish	FT
Shiner, river	*Notropis blennius*	CO	Fish	BS
Shootingstar, darkthroat	*Dodecatheon pulchellum*	OR	Plant	BS
Shootingstar, frigid	*Dodecatheon austrofrigidum*	OR	Plant	BS
Shoshonea	*Shoshonea pulvinata*	MT, WY	Plant	BS
Shrew, Alaskan tiny	*Sorex yukonicus*	AK	Mammal	BS
Shrew, Arizona	*Sorex arizonae*	NM	Mammal	BS
Shrew, Buena Vista Lake ornate	*Sorex ornatus relictus*	CA	Mammal	FE
Shrew, dwarf	*Sorex nanus*	UT	Mammal	BS
Shrew, Merriam's	*Sorex merriami*	MT	Mammal	BS
Shrew, Preble's	*Sorex preblei*	MT, NV, OR, UT	Mammal	BS
Shrew, pygmy	*Sorex hoyi*	OR	Mammal	BS
Shrike, loggerhead	*Lanius ludovicianus*	AZ, ID, MT, NM, NV, WY	Bird	BS
Shrike, San Clemente loggerhead	*Lanius ludovicianus*	CA	Bird	FE
Shrimp, California freshwater	*Syncaris pacifica*	CA	Invertebrate	FE
Shrimp, vernal pool tadpole	*Lepidurus packardi*	CA	Invertebrate	FE
Shrub, northern moon	*Dendriscocaulon intricatulum*	CA	Plant	BS
Sidalcea, bristly-stemmed	*Sidalcea hirtipes*	OR	Plant	BS
Sideband (snail), Columbia	*Monadenia fidelis columbiana*	OR	Invertebrate	BS
Sideband (snail), Deschutes	*Monadenia fidelis* ssp.	OR	Invertebrate	BS
Sideband (snail), green	*Monadenia fidelis beryllica*	OR	Invertebrate	BS
Sideband (snail), keeled	*Monadenia circumcarinata*	CA	Invertebrate	BS
Sideband (snail), Modoc rim	*Monadenia fidelis* ssp.	OR	Invertebrate	BS
Sideband (snail), Oregon/Dalles	*Monadenia fidelis minor*	OR	Invertebrate	BS
Sideband (snail), travelling	*Monadenia fidelis celeuthia*	OR	Invertebrate	BS
Sidewinder, Mojave Desert	*Crotalus cerastes*	NV, UT	Reptile	BS
Siidalcea, maple-leaved	*Sidalcea malachroides*	OR	Plant	BS
Silene, Seely's	*Silene seelyi*	OR	Plant	BS
Silverberry, American	*Elaeagnus commutata*	ID	Plant	BS

Common Name	Scientific Name	State[1]	Class	Status[2]
Silverscale, Pahrump	*Atriplex argentea*	NV	Plant	BS
Silverspot, Carson Valley	*Speyeria nokomis carsonensis*	NV	Invertebrate	BS
Skeletonweed, thorn	*Stephanomeria spinosa*	MT	Plant	BS
Skeletonweed, Wheeler's	*Chaetadelpha wheeleri*	OR	Plant	BS
Skink, Arizona	*Eumeces gilberti*	AZ	Reptile	BS
Skink, Coronado	*Eumeces skiltonianus interparietalis*	CA	Reptile	BS
Skink, many-lined	*Eumeces multivirgatus*	UT	Reptile	BS
Skipper, Carson wandering	*Pseudocopaeodes eunus obscurus*	CA, NV	Invertebrate	FE
Skipper, Dakota	*Hesperia dacotae*	MT	Invertebrate	BS
Skipper, Laguna Mountains	*Pyrgus ruralis lagunae*	CA	Invertebrate	FE
Skipper, Macneill sooty wing	*Hesperopsis gracielae*	AZ, NV	Invertebrate	BS
Skipper, Mardon	*Polites mardon*	CA, NM, OR	Invertebrate	C
Skipper, Mono Basin	*Hesperia uncas giulianii*	NV	Invertebrate	BS
Skipper, Pawnee montane	*Hesperia leonardus montana*	CO	Invertebrate	FT
Skipper, Railroad Valley	*Hesperia uncas fulvapalla*	NV	Invertebrate	BS
Skipper, Spring Mountain comma	*Hesperia comma* ssp.	NV	Invertebrate	BS
Skipper, White Mountain	*Hesperia miriamae longaevicola*	NV	Invertebrate	BS
Skipper, White River Valley	*Hesperia uncas grandiosa*	NV	Invertebrate	BS
Skipper, Yuma	*Ochlodes yuma*	OR	Invertebrate	BS
Skullcap, dwarf	*Scutellaria nana*	ID	Plant	BS
Skullcap, Holmgren's	*Scutellaria holmgreniorum*	CA	Plant	BS
Skunk, spotted	*Spilogale putorius*	MT	Mammal	BS
Skyrocket, Pagosa	*Ipomopsis polyantha*	CO	Plant	FE
Slug, salamander	*Gliabates oregonius*	OR	Invertebrate	BS
Smelowskia, Johnson's	*Smelowskia johnsonii*	AK	Plant	BS
Smelowskia, Holmgren	*Smelowskia holmgrenii*	NV	Plant	BS
Smelowskia, pearshaped	*Smelowskia pyriformis*	AK	Plant	BS
Smelt, delta	*Hypomesus transpacificus*	CA	Fish	FT
Snail, Morro shoulderband	*Helminthoglypta walkeriana*	CA	Invertebrate	FE
Snail, Big Bar hesperian	*Vespericola pressleyi*	CA	Invertebrate	BS
Snail, Bliss Rapids	*Taylorconcha serpenticola*	AZ, ID	Invertebrate	FT
Snail, Dona Ana talus	*Sonorella todseni*	NM	Invertebrate	BS
Snail, Hell's Canyon land	*Cryptomastix populi*	OR	Invertebrate	BS
Snail, Hirsute Sierra sideband	*Monadenia mormonum*	CA	Invertebrate	BS
Snail, Newcomb's littorine	*Algamorda newcombiana*	OR	Invertebrate	BS
Snail, Oregon shoulderband	*Helminthoglypta hertleini*	CA, OR	Invertebrate	BS
Snail, Pecos assiminea	*Assiminea pecos*	NM	Invertebrate	FE
Snail, Rosement talus	*Sonorella rosemontensis*	AZ	Invertebrate	C
Snail, Siskiyou shoulderband	*Monadenia chaceana*	CA, OR	Invertebrate	BS

Common Name	Scientific Name	State[1]	Class	Status[2]
Snail, Snake River physa	*Physa natricina*	ID	Invertebrate	FE
Snail, Tehama chaparral	*Trilobopsis tehamana*	CA	Invertebrate	BS
Snail, Trinity shoulderband	*Helminthoglypta talmadgei*	CA	Invertebrate	BS
Snail, Tuolumne sideband	*Monadenia tuolumneana*	CA	Invertebrate	BS
Snail, Utah valvata	*Valvata utahensis*	ID, UT	Invertebrate	BS
Snails, succineid	All species in family Succineidae	AZ	Invertebrate	BS
Snake, desert glossy	*Arizona elegans*	NV	Reptile	BS
Snake, giant garter	*Thamnophis gigas*	CA	Reptile	FT
Snake, Great Plains rat	*Elaphe guttata emoryi*	UT	Reptile	BS
Snake, longnose	*Rhinocheilus lecontei*	ID	Reptile	BS
Snake, milk	*Lampropeltis triangulum*	CO, MT, UT	Reptile	BS
Snake, Mojave patch-nosed	*Salvadora hexalepis*	UT	Reptile	BS
Snake, Mojave shovel-nosed	*Chionactis occipitalis occipitalis*	NV	Reptile	BS
Snake, narrow-headed garter	*Thamnophis rufipunctatus*	AZ, MN	Reptile	FT
Snake, Nevada shovel-nosed	*Chionactis occipitalis talpina*	NV	Reptile	BS
Snake, night	*Hypsiglena torquata*	OR	Reptile	BS
Snake, northern Mexican garter	*Thamnophis eques megalops*	AZ, NM	Reptile	FT
Snake, painted desert glossy	*Arizona elegans*	UT	Reptile	BS
Snake, ringneck	*Diadophis punctatus*	ID	Reptile	BS
Snake, San Francisco garter	*Thamnophis sirtalis*	CA	Reptile	FE
Snake, sharptail	*Contia tenuis*	OR	Reptile	BS
Snake, smooth green	*Opheodrys vernalis*	UT	Reptile	BS
Snake, Sonoran lyre	*Trimorphodon biscutatus* ssp. *lambda*	UT	Reptile	BS
Snake, Tucson shovel-nosed	*Chionactis occipitalis klauberi*	AZ	Reptile	C
Snake, two-striped garter	*Thamnophis hammondii*	CA	Reptile	BS
Snake, Utah blind	*Leptotphlops humilis*	UT	Reptile	BS
Snake, western ground	*Sonora semiannulata*	ID	Reptile	BS
Snake, western hog-nosed	*Heterodon nasicus*	MT	Reptile	BS
Snake-root, black	*Sanicula marilandica*	OR	Plant	BS
Snakeweed, Lone Mesa	*Gutierrezia elegans*	CO	Plant	BS
Snapdragon, dimorphic	*Antirrhinum subcordatum*	CA	Plant	BS
Snowberry, creeping	*Gaultheria hispidula*	OR	Plant	BS
Snowberry, long-flowered	*Symphoricarpos longiflorus*	OR	Plant	BS
Snow-wreath, Shasta	*Neviusia cliftonii*	CA	Plant	BS
Soaproot, dwarf	*Chlorogalum pomeridianum*	CA	Plant	BS
Soaproot, Red Hills	*Chlorogalum grandiflorum*	CA	Plant	BS
Softshell, spiny	*Apalone spinifera*	MT	Reptile	BS
Sorrel, Cape Krause	*Rumex krausei*	AK	Plant	BS
Spadefoot, Great Basin	*Spea intermontana*	CO, WY	Amphibian	BS

Common Name	Scientific Name	State[1]	Class	Status[2]
Spadefoot, plains	*Spea bombifrons*	MT	Amphibian	BS
Sparrow, Arizona grasshopper	*Ammodramus savannarum*	AZ	Bird	BS
Sparrow, Baird's	*Ammodramus bairdii*	MT, NM, WY	Bird	BS
Sparrow, black-throated	*Amphispiza bilineata*	OR	Bird	BS
Sparrow, Botteri's	*Peucaea botterii*	AZ	Bird	BS
Sparrow, Brewer's	*Spizella breweri*	CO, ID, MT, NV, WY	Bird	BS
Sparrow, grasshopper	*Ammodramus savannarum*	ID, OR, UT	Bird	BS
Sparrow, large-billed savannah	*Passerculus sandwichensis*	AZ	Bird	BS
Sparrow, Leconte's	*Ammodramus leconteii*	MT	Bird	BS
Sparrow, Nelson's sharp-tailed	*Ammodramus nelsoni*	MT	Bird	BS
Sparrow, Oregon vesper	*Pooecetes gramineus*	OR	Bird	BS
Sparrow, sage	*Amphispiza belli*	ID, MT, OR, WY	Bird	BS
Sparrow, San Clemente sage	*Amphispiza belli*	CA	Bird	FT
Spectaclepod, beach	*Dithyrea maritima*	CA	Plant	BS
Spider-flower, many-stemmed	*Cleome multicaulis*	CO, WY	Plant	BS
Spikedace	*Meda fulgida*	AZ, NM	Fish	FE
Spikerush, beaked	*Eleocharis rostellata*	MT	Plant	BS
Spikerush, Bolander's	*Eleocharis bolanderi*	OR	Plant	BS
Spinedace, Big Spring	*Lepidomeda mollispinis pratensis*	NV	Fish	FT
Spinedace, little Colorado	*Lepidomeda vittata*	AZ	Fish	FT
Spinedace, Virgin	*Lepidomeda mollispinis*	AZ, NV, UT	Fish	BS
Spinedace, White River	*Lepidomeda albivallis*	NV	Fish	FE
Spineflower, Ben Lomond	*Chorizanthe pungens* var. *hartwegiana*	CA	Plant	FE
Spineflower, Brewer's	*Chorizanthe breweri*	CA	Plant	BS
Spineflower, Howell's	*Chorizanthe howellii*	CA	Plant	FE
Spineflower, Indian Valley	*Aristocapsa insignis*	CA	Plant	BS
Spineflower, Monterey	*Chorizanthe pungens* var. *pungens*	CA, CO	Plant	FT
Spineflower, Orcutt's	*Chorizanthe orcuttiana*	CA	Plant	FE
Spineflower, Parry's	*Chorizanthe parryi* var. *parryi*	CA	Plant	BS
Spineflower, robust	*Chorizanthe robusta* var. *robusta*	CA	Plant	FE
Spineflower, San Benito	*Chorizanthe biloba*	CA	Plant	BS
Spineflower, San Fernando Valley	*Chorizanthe parryi* var. *fernandina*	CA	Plant	C
Spineflower, slender-horned	*Dodecahema leptoceras*	CA	Plant	FE
Spineflower, Sonoma	*Chorizanthe valida*	CA	Plant	FE
Spineflower, straight-awned	*Chorizanthe rectispina*	CA	Plant	BS
Spirea, subalpine	*Spiraea splendens*	OR	Plant	BS

Common Name	Scientific Name	State[1]	Class	Status[2]
Spleenwort, Dalhouse	*Asplenium dalhousiae*	AZ	Plant	BS
Spleenwort, green	*Asplenium trichomanes-ramosum*	CO, ID, OR	Plant	BS
Splittail, Sacramento	*Pogonichthys macrolepidotus*	CA	Fish	FT
Springbeauty, arctic	*Claytonia arctica*	AK	Plant	BS
Springfish, Hiko White River	*Crenichthys baileyi grandis*	NV	Fish	FE
Springfish, Moapa White River	*Crenichthys baileyi moapae*	NV	Fish	BS
Springfish, Railroad Valley	*Crenichthys nevadae*	NV	Fish	FT
Springfish, White River	*Crenichthys baileyi baileyi*	NV	Fish	FE
Springparsley, snowline	*Cymopterus nivalis*	OR	Plant	BS
Springparsley, Uinta basin	*Cymopterus duchesnensis*	CO	Plant	BS
Springsnail, alamosa	*Tryonia alamosae*	NM	Invertebrate	FE
Springsnail, Bruneau Hot	*Pyrgulopsis bruneauensis*	ID, MT, WY	Invertebrate	FE
Springsnail, Byla's	*Pyrgulopsis arizonae*	AZ	Invertebrate	BS
Springsnail, Chupadera	*Pyrgulopsis chupaderae*	NM	Invertebrate	C
Springsnail, Crooked Creek	*Pyrgulopsis intermedia*	OR	Invertebrate	BS
Springsnail, desert	*Pyrgulopsis deserta*	AZ	Invertebrate	BS
Springsnail, distal gland	*Pyrgulopsis nanus*	NV	Invertebrate	BS
Springsnail, elongate gland	*Pyrgulopsis isolatus*	NV	Invertebrate	BS
Springsnail, elongate Mud Meadows	*Pyrgulopsis notidicola*	NV	Invertebrate	C
Springsnail, Fairbanks	*Pyrgulopsis fairbanksensis*	NV	Invertebrate	BS
Springsnail, Gila	*Pyrgulopsis gilae*	NM	Invertebrate	C
Springsnail, Grand Wash	*Pyrgulopsis bacchus*	AZ	Invertebrate	BS
Springsnail, Harney Lake	*Pyrgulopsis hendersoni*	OR	Invertebrate	BS
Springsnail, Huachuca	*Pyrgulopsis thompsoni*	AZ	Invertebrate	C
Springsnail, Idaho	*Fontelicella idahoensis*	ID	Invertebrate	FE
Springsnail, Jackson Lake	*Pyrgulopsis robusta*	OR	Invertebrate	BS
Springsnail, Kingman	*Pyrgulopsis conica*	AZ	Invertebrate	BS
Springsnail, Koster's	*Juturnia kosteri*	NM	Invertebrate	FE
Springsnail, Malheur cave	*Oncopodura mala*	CA	Invertebrate	BS
Springsnail, New Mexico	*Pyrgulopsis thermalis*	NM	Invertebrate	C
Springsnail, Owyhee Hot	*Pyrgulopsis owyheensis*	OR	Invertebrate	BS
Springsnail, page	*Pyrgulopsis morrisoni*	AZ	Invertebrate	C
Springsnail, Roswell	*Pyrgulopsis roswellensis*	NM	Invertebrate	FE
Springsnail, San Bernardino	*Pyrgulopsis bernardina*	AZ	Invertebrate	FP
Springsnail, Socorro	*Pyrgulopsis neomexicana*	NM	Invertebrate	FE
Springsnail, Three Forks	*Pyrgulopsis trivialis*	AZ	Invertebrate	FP
Springsnails, hydrobiid	All species in genus *Pyrgulopsis*	AZ	Invertebrate	BS
Springtail, crystal	*Pyrgulopsis crystalis*	NV	Invertebrate	BS
Spruce, white	*Picea glauca*	ID	Plant	BS
Spurge, flat-seeded	*Chamaesyce platysperma*	CA	Plant	BS

Common Name	Scientific Name	State[1]	Class	Status[2]
Spurge, Hoover's	*Chamaesyce hooveri*	CA, UT	Plant	FT
Spurge, Stony Creek	*Chamaesyce ocellata*	CA	Plant	BS
Squirrel, Coachella Valley round-tailed ground	*Spermophilus tereticaudus*	CA	Mammal	C
Squirrel, Mohave ground	*Spermophilus mohavensis*	CA	Mammal	BS
Squirrel, Mount Graham red	*Tamiasciurus hudsonicus*	AZ	Mammal	FE
Squirrel, Nelson's antelope	*Ammospermophilus nelsoni*	CA	Mammal	BS
Squirrel, Northern Idaho ground	*Spermophilus brunneus brunneus*	ID	Mammal	FT
Squirrel, Osgood's arctic ground	*Spermophilus parryii*	AK	Mammal	BS
Squirrel, Palm Springs round-tailed ground	*Spermophilus tereticaudus*	CA	Mammal	C
Squirrel, rock	*Spermophilus variegatus*	ID	Mammal	BS
Squirrel, Southern Idaho ground	*Spermophilus brunneus*	ID	Mammal	C
Squirrel, Washington ground	*Urocitellus washingtoni*	OR	Mammal	C
Squirrel, western grey	*Sciurus griseus*	OR	Mammal	BS
St. Johns-wort, large Canadian	*Hypericum majus*	ID	Plant	BS
Stanleya, biennial	*Stanleya confertiflora*	ID, OR	Plant	BS
Star-tulip, Shirley Meadows	*Calochortus westonii*	CA	Plant	BS
Steelhead (California Central Valley DPS[4])	*Oncorhynchus mykiss*	CA	Fish	FT
Steelhead (Central California Coast DPS)	*Oncorhynchus mykiss*	CA	Fish	FT
Steelhead (Lower Columbia river DPS)	*Oncorhynchus mykiss*	OR	Fish	FT
Steelhead (Middle Columbia River DPS)	*Oncorhynchus mykiss*	OR	Fish	FT
Steelhead (Northern California DPS)	*Oncorhynchus mykiss*	CA	Fish	FT
Steelhead (Snake River Basin DPS)	*Oncorhynchus mykiss*	ID, OR	Fish	FT
Steelhead (South Central California Coast DPS)	*Oncorhynchus mykiss*	CA	Fish	FT
Steelhead (Southern California DPS)	*Oncorhynchus mykiss*	CA	Fish	FE
Steelhead (Upper Columbia River DPS)	*Oncorhynchus mykiss*	OR	Fish	FT
Steelhead (Upper Willamette River DPS)	*Oncorhynchus mykiss*	OR	Fish	FT
Stenotus, woolly	*Stenotus lanuginosus*	CA	Plant	BS
Stickleaf, September 11	*Mentzelia memorabilis*	AZ	Plant	BS
Stickleaf, smooth	*Mentzelia mollis*	ID, NV, OR	Plant	BS
Stickleaf, southwest	*Mentzelia argillosa*	CO	Plant	BS

Common Name	Scientific Name	State[1]	Class	Status[2]
Stickleback, unarmored threespine	*Gasterosteus aculeatus williamsoni*	CA	Fish	FE
Stickseed, beautiful	*Hackelia bella*	OR	Plant	BS
Stickseed, Cronquist's	*Hackelia cronquistii*	ID, OR	Plant	BS
Stickseed, diffuse	*Hackelia diffusa*	OR	Plant	BS
Stickseed, rough	*Hackelia hispida* var. *disjuncta*	OR	Plant	BS
Stickseed, sagebrush	*Hackelia hispida*	OR	Plant	BS
Stickseed, showy	*Hackelia venusta*	OR	Plant	FE
Stickseed, Three Forks	*Hackelia ophiobia*	ID, OR	Plant	BS
Stitchwort, James'	*Pseudostellaria jamesiana*	MT	Plant	BS
Stonecat	*Noturus flavus*	CO	Fish	BS
Stonecrop, Applegate	*Sedum oblanceolatum*	CA, OR	Plant	BS
Stonecrop, Bartram	*Graptopetalum bartramii*	AZ	Plant	BS
Stonecrop, Canyon Creek	*Sedum paradisum*	CA	Plant	BS
Stonecrop, Feather River	*Sedum albomarginatum*	CA	Plant	BS
Stonecrop, Lake County	*Parvisedum leiocarpum*	CA	Plant	FE
Stonecrop, Red Mountain	*Sedum eastwoodiae*	CA	Plant	C
Stonecrop, Rogue River	*Sedum moranii*	OR	Plant	BS
Stonefly, meltwater Lednian	*Lednia tumana*	MT	Invertebrate	C
Stonefly, Wahkeena Falls flightless	*Zapada wahkeena*	OR	Invertebrate	BS
Storm-petrel, ashy	*Oceanodroma homochroa*	CA	Bird	BS
Storm-petrel, fork-tailed	*Oceanodroma furcata*	CA	Bird	BS
Strap-lichen, ciliate	*Heterodermia leucomelos*	CA	Plant	BS
Strawberry, Idaho	*Waldsteinia idahoensis*	ID	Plant	BS
Streptanthus, Howell's	*Streptanthus howellii*	OR	Plant	BS
Sturgeon, North American green	*Acipenser medirostris*	AK, CA, OR	Fish	FT
Sturgeon, pallid	*Scaphirhynchus albus*	CO, MT, WY	Fish	FE
Sturgeon, white (Kootenai River population)	*Acipenser transmontanus*	ID, MT	Fish	FE
Stylocline	*Stylocline filaginea*	ID	Plant	BS
Sucker, blue	*Cycleptus elongatus*	MT, WY	Fish	BS
Sucker, bluehead	*Catostomus discobolus*	AZ, CO, UT, WY	Fish	BS
Sucker, desert	*Catostomus clarki*	AZ, NM, UT	Fish	BS
Sucker, flannelmouth	*Catostomus latipinnis*	AZ, CO, UT, WY	Fish	BS
Sucker, Goose Lake	*Catostomus occidentalis*	OR	Fish	BS
Sucker, June	*Chasmistes liorus*	UT	Fish	FE
Sucker, little Colorado	*Catostomus* sp.	AZ, UT	Fish	BS
Sucker, Lost River	*Deltistes luxatus*	CA, OR	Fish	FE
Sucker, Meadow Valley Wash desert	*Catostomus clarki*	AZ, NV	Fish	BS

Common Name	Scientific Name	State[1]	Class	Status[2]
Sucker, Modoc	*Catostomus microps*	CA, OR	Fish	FE
Sucker, mountain	*Catostomus platyrhynchus*	CO, OR	Fish	BS
Sucker, razorback	*Xyrauchen texanus*	AZ, CA, CO, NM, NV, UT, WY	Fish	FE
Sucker, Rio Grande	*Catostomus plebeius*	CO	Fish	BS
Sucker, Santa Ana	*Catostomus santaanae*	CA	Fish	FT
Sucker, shortnose	*Chasmistes brevirostris*	CA, OR	Fish	FE
Sucker, Sonora	*Catostomus insignis*	AZ, NM	Fish	BS
Sucker, Tahoe	*Catostomus tahoensis*	OR	Fish	BS
Sucker, Wall Canyon	*Catastomus* sp. (undescribed, =*murivallis*)	CA, NV	Fish	BS
Sucker, Warner	*Catostomus warnerensis*	CA, NV, OR	Fish	FT
Sucker, Zuni bluehead	*Catostomus discobolus*	AZ, NM	Fish	C
Suckleya, poison	*Suckleya suckleyana*	MT	Plant	BS
Suksdorfia, violet	*Suksdorfia violacea*	OR	Plant	BS
Sullivantia, Oregon	*Sullivantia oregana*	OR	Plant	BS
Sumac, Kearney	*Rhus kearneyi*	AZ	Plant	BS
Sunburst, Hartweg's golden	*Pseudobahia bahiifolia*	CA	Plant	FE
Sunburst, San Joaquin Adobe	*Pseudobahia peirsonii*	CA	Plant	FT
Suncup, Grand Junction	*Camissonia eastwoodiae*	CO	Plant	BS
Sunflower, Algodones Dunes	*Helianthus niveus*	CA	Plant	BS
Sunflower, Pecos	*Helianthus paradoxus*	NM	Plant	FT
Sunray, Ash Meadows	*Enceliopsis nudicaulis* var. *corrugata*	CA, NV	Plant	FT/BS
Sunray, silverleaf	*Enceliopsis argophylla*	AZ, NV	Plant	BS
Sunshine, Sonoma	*Blennosperma bakeri*	CA	Plant	FE
Swallow, bank	*Riparia riparia*	CA	Bird	BS
Swan, trumpeter	*Cygnus buccinator*	AK, ID, MT, OR, WY	Bird	BS
Sweetpea, Bullfrog Hills	*Lathyrus hitchcockianus*	NV	Plant	BS
Swertia, Umpqua	*Frasera umpquaensis*	OR	Plant	BS
Swift, black	*Cypseloides niger*	CO, ID, OR, UT	Bird	BS
Swift, Vaux's	*Chaetura vauxi*	ID	Bird	BS
Swordfern, California	*Polystichum californicum*	OR	Plant	BS
Swordfern, Kruckeberg's	*Polystichum kruckebergii*	ID	Plant	BS
Tail-dropper, spotted	*Prophysaon vanattae*	OR	Invertebrate	BS
Tansy, cinquefoil	*Sphaeromeria potentilloides*	ID	Plant	BS
Tansy, rock	*Sphaeromeria capitata*	CO	Plant	BS
Tansymustard, Wyoming	*Descurainia torulosa*	WY	Plant	BS
Taraxacum, California	*Taraxacum californicum*	CA	Plant	FE

Common Name	Scientific Name	State[1]	Class	Status[2]
Tarplant, Congdon's	*Centromadia parryi* ssp. *congdonii*	CA	Plant	BS
Tarplant, Gaviota	*Deinandra increscens* ssp. *villosa*	CA	Plant	FE
Tarplant, Hall's	*Deinandra halliana*	CA	Plant	BS
Tarplant, Mojave	*Deinandra mohavensis*	CA	Plant	BS
Tarplant, Otay	*Deinandra conjugens*	CA	Plant	FT
Tarplant, pappose	*Centromadia parryi* ssp. *parryi*	CA	Plant	BS
Tarplant, Red Rock	*Deinandra arida*	CA	Plant	BS
Tarplant, Santa Cruz	*Holocarpha macradenia*	CA	Plant	FT
Tarplant, Santa Suzana	*Deinandra minthornii*	CA	Plant	BS
Tarplant, scabrid alpine	*Anisocarpus scabridus*	CA	Plant	BS
Tarplant, Tecate	*Deinandra floribunda*	CA	Plant	BS
Tauschia, Hoover's	*Tauschia hooveri*	OR	Plant	BS
Tern, black	*Chlidonias niger*	CO, ID, MT, NM, NV, UT	Bird	BS
Tern, California least	*Sterna antillarum browni*	AZ, CA	Bird	FE
Tern, Caspian	*Sterna caspia*	UT	Bird	BS
Tern, least (interior)	*Sterna antillarum*	CO, MT, NM, WY	Bird	FE
Tetracoccus, Parry's	*Tetracoccus dioicus*	CA	Plant	BS
Thelypody, arrow	*Thelypodium sagittatum*	MT	Plant	BS
Thelypody, arrow-leaf	*Thelypodium eucosmum*	OR	Plant	BS
Thelypody, Howell's	*Thelypodium howellii*	CA	Plant	BS
Thelypody, Howell's spectacular	*Thelypodium howellii* ssp. *spectabilis*	OR	Plant	FT
Thelypody, northwestern	*Thelypody paniculatum*	MT	Plant	BS
Thelypody, short-podded	*Thelypodium brachycarpum*	OR	Plant	BS
Thelypody, wavy-leaf	*Thelypodium repandum*	ID	Plant	BS
Thistle, Ashland	*Cirsium ciliolatum*	CA	Plant	BS
Thistle, Cedar Rim	*Cirsium aridum*	WY	Plant	BS
Thistle, Chorro Creek Bog	*Cirsium fontinale* var. *obispoense*	CA	Plant	FE
Thistle, compact cobwebby	*Cirsium occidentale*	CA	Plant	BS
Thistle, fountain	*Cirsium fontinale*	CA	Plant	FE
Thistle, La Graciosa	*Cirsium scariosum* var. *loncholepis*	CA	Plant	FE
Thistle, Mount Hamilton	*Cirsium fontinale* var. *campylon*	CA	Plant	BS
Thistle, Ownbey's	*Cirsium ownbeyi*	CO, WY	Plant	BS
Thistle, Pitcher's	*Cirsium pitcheri*	CA	Plant	FT
Thistle, Rocky Mountain	*Cirsium perplexans*	CO	Plant	BS
Thistle, Sacramento Mountains	*Cirsium vinaceum*	NM	Plant	FT

Common Name	Scientific Name	State[1]	Class	Status[2]
Thistle, slough	*Cirsium crassicaule*	CA, WY	Plant	BS
Thistle, Suisun	*Cirsium hydrophilum* var. *hydrophilum*	CA	Plant	FE
Thistle, surf	*Cirsium rhothophilum*	CA	Plant	BS
Thistle, Virgin River	*Cirsium mohavense*	NV	Plant	BS
Thistle, Wright's marsh	*Cirsium wrightii*	AZ, NM	Plant	C
Thornbush, seaside	*Kaernefeltia californica*	CA	Plant	BS
Thornmint, San Diego	*Acanthomintha ilicifolia*	CA	Plant	FT
Thornmint, San Mateo	*Acanthomintha obovata*	CA	Plant	FE
Thrasher, Bendire's	*Toxostoma bendirei*	CA, NV	Bird	BS
Thrasher, Crissal	*Toxostoma crissale*	UT	Bird	BS
Thrasher, Le Conte's	*Toxostoma lecontei*	AZ, CA, NV	Bird	BS
Thrasher, Le Conte's (San Joaquin population)	*Toxostoma lecontei lecontei*	CA	Bird	BS
Thrasher, sage	*Oreoscoptes montanus*	MT, NV, WY	Bird	BS
Threadsnake, western	*Leptotyphlops humilis*	UT	Reptile	BS
Threadstem, rigid	*Nemacladus rigidus*	ID, WY	Plant	BS
Thrush, Swainson's	*Catharus ustulatus*	ID	Bird	BS
Tidy-tips, Munz's	*Layia munzii*	CA	Plant	BS
Tidy-tips, rayless	*Layia discoidea*	CA	Plant	BS
Tightcoil, Crater Lake	*Pristiloma arcticum*	OR	Invertebrate	BS
Tightcoil, crowned	*Pristiloma pilsbryi*	OR	Invertebrate	BS
Timwort	*Cicendia quadrangularis*	OR	Plant	BS
Toad, Amargosa	*Bufo nelsoni*	NV	Amphibian	BS
Toad, Arizona	*Bufo microscaphus*	CA, NM, UT	Amphibian	BS
Toad, Arroyo	*Bufo californicus*	CA	Amphibian	FE
Toad, black	*Anaxyrus exsul*	CA	Amphibian	BS
Toad, boreal	*Anaxyrus (=Bufo) boreas boreas*	CO, ID, MT, UT, WY	Amphibian	C
Toad, Canadian	*Bufo hemiophrys*	MT	Amphibian	BS
Toad, Couch's spadefoot	*Scaphiopus couchi*	CA	Amphibian	BS
Toad, Dixie Valley	*Bufo boreas* ssp.	NV	Amphibian	BS
Toad, Great Plains	*Bufo cognatus*	MT, UT	Amphibian	BS
Toad, Great Plains narrow-mouthed	*Gastrophryne olivacea*	AZ	Amphibian	BS
Toad, Sonoran green	*Bufo retiformis*	AZ	Amphibian	BS
Toad, western spadefoot	*Scaphiopus hammondi*	CA	Amphibian	BS
Toad, Woodhouse's	*Bufo woodhousii*	OR	Amphibian	BS
Toad, Wyoming	*Bufo baxteri*	WY	Amphibian	FE
Toad, Yosemite	*Anaxyrus canorus*	CA	Amphibian	FT
Toadflax, blue	*Nuttallanthus texanus*	MT	Plant	BS
Tobacco, coyote	*Nicotiana attenuata*	OR	Plant	BS
Toothcup, lowland	*Rotala ramosior*	OR	Plant	BS

Common Name	Scientific Name	State[1]	Class	Status[2]
Topminnow, Gila	*Poeciliopsis occidentalis*	AZ, NM	Fish	FE
Topminnow, plains	*Fundulus sciadicus*	CO	Fish	BS
Tortoise, desert	*Gopherus agassizii*	AZ, CA, NV, UT	Reptile	FT
Towhee, green-tailed	*Pipilo chlorurus*	ID	Bird	BS
Towhee, Inyo California	*Pipilo crissalis eremophilus*	CA	Bird	FT
Townsendia, last chance	*Townsendia aprica*	CA, UT	Plant	FE/FT
Townsendia, mountain	*Townsendia montana*	OR	Plant	BS
Townsendia, Parry's	*Townsendia parryi*	OR	Plant	BS
Townsendia, scapose	*Townsendia scapigera*	ID	Plant	BS
Townsendia, showy	*Townsendia florifera*	MT	Plant	BS
Tree-anemone	*Carpenteria californica*	CA	Plant	BS
Treefrog, Arizona	*Hyla wrightorum*	AZ	Amphibian	C
Treefrog, canyon	*Hyla arenicolor*	CO, WY	Amphibian	BS
Treefrog, lowland burrowing	*Smilisca fodiens*	AZ	Amphibian	BS
Trefoil, stipuled	*Lotus stipularis*	OR	Plant	BS
Trillium, Siskiyou	*Trillium kurabayashii*	OR	Plant	BS
Trillium, small-flowered	*Trillium parviflorum*	OR	Plant	BS
Trout, Apache	*Oncorhynchus apache*	AZ	Fish	FT
Trout, Bonneville cutthroat	*Oncorhynchus clarki utah*	ID, NV, UT, WY	Fish	BS
Trout, bull	*Salvelinus confluentus*	ID, MT, NV, OR	Fish	FT, XN
Trout, coastal cutthroat	*Oncorhynchus clarkii clarkii*	OR	Fish	BS
Trout, Colorado River cutthroat	*Oncorhynchus clarki pleuriticus*	CO, UT, WY	Fish	BS
Trout, fine-spotted Snake River cutthroat	*Oncorhynchus clarki* ssp.	WY	Fish	BS
Trout, Gila	*Oncorhynchus gilae*	AZ, NM	Fish	FT
Trout, Great Basin redband	*Oncorhynchus mykiss* ssp.	OR	Fish	BS
Trout, greenback cutthroat	*Oncorhynchus clarki* ssp. *stomias*	CO, UT	Fish	FT
Trout, inland Columbia Basin redband	*Oncorhynchus mykiss gairdneri*	NV	Fish	BS
Trout, interior redband	*Oncorhynchus mykiss gibbsi*	ID, NV, OR	Fish	BS
Trout, interior redband (Jenny Creek)	*Oncorhynchus mykiss gairdneri*	OR	Fish	BS
Trout, Lahontan cutthroat	*Oncorhynchus clarki* ssp. *henshawi*	CA, CO, NV, OR, UT	Fish	FT
Trout, Little Kern Golden	*Oncorhynchus aguabonita*	CA	Fish	FT
Trout, Paiute cutthroat	*Oncorhynchus clarki seleniris*	CA	Fish	FT
Trout, Rio Grande cutthroat	*Oncorhynchus clarki virginalis*	CO, NM	Fish	C
Trout, westslope cutthroat	*Oncorhynchus clarki lewisi*	ID, MT, OR	Fish	BS

Common Name	Scientific Name	State[1]	Class	Status[2]
Trout, Yellowstone cutthroat	*Oncorhynchus clarki bouvieri*	ID, MT, UT, WY	Fish	BS
Truffle, hypogeous	*Choiromyces venosus*	CA, OR	Fungi	BS
Truffle, yellow false	*Leucogaster citrinus*	CA, OR	Fungi	BS
Tryonia, Amargosa	*Tryonia variegata*	NV	Invertebrate	BS
Tryonia, Gila	*Tryonia gilae*	AZ	Invertebrate	BS
Tryonia, grated	*Tryonia clathrata*	NV	Invertebrate	BS
Tryonia, minute	*Tryonia ericae*	NV	Invertebrate	BS
Tryonia, Point of Rocks	*Tryonia elata*	NV	Invertebrate	BS
Tryonia, Sportinggoods	*Tryonia angulata*	NV	Invertebrate	BS
Tuctoria, Greene's	*Tuctoria greenei*	CA	Plant	FE
Turtle, desert ornate box	*Terrapene ornata*	AZ	Reptile	BS
Turtle, northwestern pond	*Actinemys (=Clemmys) marmorata marmorata*	OR	Reptile	BS
Turtle, painted	*Chrysemys picta*	OR	Reptile	BS
Turtle, snapping	*Chelydra serpentina*	MT, UT	Reptile	BS
Turtle, Sonoyta mud (Sonoran)	*Kinosternon sonoriense longifemorale*	AZ, NM	Reptile	C
Turtle, southwestern pond	*Actinemys marmorata pallida*	CA	Reptile	BS
Turtle, spiny softshell	*Trionyx spiniferus*	MT	Reptile	BS
Twayblade	*Liparis loeselii*	OR	Plant	BS
Twayblade, northern	*Listera borealis*	CO, OR	Plant	BS
Twinpod, Chamber's	*Physaria chambersii*	OR	Plant	BS
Twinpod, common	*Physaria didymocarpa* ssp. *lanata*	OR	Plant	BS
Twinpod, Dorn's	*Physaria dornii*	CA, WY	Plant	BS
Twinpod, Dudley Bluffs (piceance)	*Physaria obcordata*	CO, UT	Plant	FT
Twinpod, Rocky Mountain	*Physaria saximontana*	WY	Plant	BS
Twinpod, tufted	*Physaria condensata*	WY	Plant	BS
Ulota, large-spored	*Ulota megalospora*	ID	Plant	BS
Veery	*Catharus fuscescens*	ID	Bird	BS
Vervain, Red Hills	*Verbena californica*	CA	Plant	FT
Vetchling, Grime's	*Lathyrus grimesii*	NV	Plant	BS
Violet, kidney-leaved	*Viola renifolia*	OR	Plant	BS
Violet, rock	*Viola lithion*	NV	Plant	BS
Violet, western bog	*Viola primulifolia*	OR	Plant	BS
Vireo, Bell's	*Vireo bellii*	CA, NM, UT	Bird	BS
Vireo, gray	*Vireo vicinior*	CA	Bird	BS
Vireo, least Bell's	*Vireo bellii pusillus*	CA	Bird	FE
Vireo, solitary	*Vireo solitarius*	ID	Bird	BS
Vole, Amargosa	*Microtus californicus scirpensis*	CA	Mammal	FE

Common Name	Scientific Name	State[1]	Class	Status[2]
Vole, Ash Meadows montane	*Microtus montanus nevadensis*	NV	Mammal	BS
Vole, Hualapai Mexican	*Microtus mexicanus hualpaiensis*	AZ	Mammal	FE
Vole, Mexican	*Microtus mexicanus*	UT	Mammal	BS
Vole, Owens Valley California	*Microtus californicus vallicola*	CA	Mammal	BS
Vole, Pahranagat Valley montane	*Microtus montanus fucosus*	NV	Mammal	BS
Vole, Potholes meadow	*Microtus pennsylvanicus kincaidi*	OR	Mammal	BS
Vole, red tree	*Arborimus longicaudus*	OR	Mammal	BS
Vole, Shaw Island Townsend's	*Microtus townsendii pugeti*	OR	Mammal	BS
Vole, Virgin River montane	*Microtus montanus rivularis*	UT	Mammal	BS
Wafer-parsnip, Evert's	*Cymopterus evertii*	WY	Plant	BS
Wafer-parsnip, William's	*Cymopterus williamsii*	WY	Plant	BS
Wahoo, western	*Euonymus occidentalis*	OR	Plant	BS
Walker, Pacific	*Pomatiopsis californica*	OR	Invertebrate	BS
Walker, robust	*Pomatiopsis binneyi*	OR	Invertebrate	BS
Wallflower	*Erysimum asperum*	AK	Plant	BS
Wallflower, Ben Lomond	*Erysimum teretifolium*	CA	Plant	FE
Wallflower, coast	*Erysimum ammophilum*	CA	Plant	BS
Wallflower, Contra Costa	*Erysimum capitatum*	CA	Plant	FE
Wallflower, Humboldt Bay	*Erysimum menziesii*	CA	Plant	FE
Wallflower, Inuit	*Parrya nauruaq*	AK	Plant	BS
Wallflower, Menzie's	*Erysimum menziesii*	CA	Plant	FE
Walrus, Pacific	*Odobenus rosmarus*	AK	Mammal	C
Warbler, blackpoll	*Dendroica striata*	AK	Bird	BS
Warbler, black-throated gray	*Dendroica nigrescens*	OR	Bird	BS
Warbler, Lucy's	*Vermivora luciae*	CA	Bird	BS
Warbler, Macgillivray's	*Oporonis tolmiei*	ID	Bird	BS
Warbler, Townsend's	*Dendroica townsendi*	ID	Bird	BS
Warbler, Virginia's	*Vermivora virginiae*	ID	Bird	BS
Warbler, Wilson's	*Wilsonia pusilla*	ID	Bird	BS
Warbler, yellow	*Dendroica petechia*	ID	Bird	BS
Watercress, Gambel's	*Rorippa gambellii*	CA	Plant	FE
Waterhemlock, bulb-bearing	*Cicuta bulbifera*	ID, OR	Plant	BS
Water-meal, Columbia	*Wolffia columbiana*	OR	Plant	BS
Water-meal, dotted	*Wolffia borealis*	OR	Plant	BS
Water-pimpernel	*Samolus parviflorus*	OR	Plant	BS
Waterplantain, fringed	*Damasonium californicum*	ID, OR	Plant	BS
Water-starwort, The Dalles	*Callitriche fassettii*	OR	Plant	BS
Water-starwort, winged	*Callitriche marginata*	OR	Plant	BS

Common Name	Scientific Name	State[1]	Class	Status[2]
Waterthrush, northern	*Seiurus noveboracensis*	OR	Bird	BS
Water-umbel, Huachuca	*Lilaeopsis schaffneriana* var. *recurva*	AZ	Plant	FE
Waterweed, long sheath	*Elodea bifoliata*	MT	Plant	BS
Waterwort, short seeded	*Elatine brachysperma*	OR	Plant	BS
Wavewing, Ibapah	*Cymopterus ibapensis*	AZ, NV	Plant	BS
Wavewing, intermountain	*Cymopterus basalticus*	NV	Plant	BS
Wavewing, longstalk	*Cymopterus longipes*	OR	Plant	BS
Waxflower	*Jamesia tetrapetala*	NV	Plant	BS
Waxwing, cedar	*Bombycilla cedrorum*	OR	Bird	BS
Weed, red poverty	*Monolepis pusilla*	OR	Plant	BS
Weevil, big dune miloderes	*Miloderes* sp.	NV	Invertebrate	BS
Westernslug, Tillamook	*Hesperarion mariae*	OR	Invertebrate	BS
Whale, blue	*Balaenoptera musculus*	AK, CA, OR	Mammal	FE
Whale, bowhead	*Balaena mysticetus*	AK	Mammal	FE
Whale, finback	*Balaenoptera physalus*	AK, CA	Mammal	FE
Whale, gray	*Eschrichtius robustus*	OR	Mammal	FE
Whale, humpback	*Megaptera novaeangliae*	AK, CA, OR	Mammal	FE
Whale, killer	*Orcinus orca*	CA, OR	Mammal	FE
Whale, Sei	*Balaenoptera borealis*	CA	Mammal	FE
Whale, sperm	*Physeter catodon*	AK, CA	Mammal	FE
Whip-scorpion, Shoshone cave	*Trithyreus shoshonensis*	CA, NV	Invertebrate	BS
Whipsnake (=striped racer), Alameda	*Masticophis lateralis*	CA	Reptile	FT
Whipsnake, striped	*Masticophis taeniatus*	OR	Reptile	BS
Whiptail, Arizona striped	*Aspidoscelis arizonae*	AZ	Reptile	BS
Whiptail, canyon spotted	*Cnemidophorus burti*	AZ, NM	Reptile	BS
Whiptail, gray checkered	*Cnemidophorus dixoni*	NM	Reptile	BS
Whiptail, plateau striped	*Cnemidophorus velox*	UT	Reptile	BS
Whitefish, pygmy	*Prosopium coulteri*	OR	Fish	BS
Whitlow-grass, Adam's	*Draba pauciflora*	AK	Plant	BS
Whitlow-grass, alpine	*Draba micropetala*	AK	Plant	BS
Whitlow-grass, Howell's	*Draba howellii*	OR	Plant	BS
Whitlow-grass, Murray's	*Draba murrayi*	AK	Plant	BS
Whitlow-grass, Standley	*Draba standleyi*	NM	Plant	BS
Wild-buckwheat, gypsum	*Eriogonum gypsophilum*	NM	Plant	FT
Wild-buckwheat, Yukon	*Eriogonum flavum*	AK	Plant	BS
Wild-rye, dune	*Elymus simplex*	WY	Plant	BS
Wild-rye, sand	*Leymus flavescens*	MT	Plant	BS
Willow, autumn	*Salix serissima*	CO	Plant	BS
Willow, False Mountain	*Salix pseudomonticola*	ID	Plant	BS
Willow, Farr's	*Salix farriae*	OR	Plant	BS

Common Name	Scientific Name	State[1]	Class	Status[2]
Willow, glaucus	*Salix glauca*	OR	Plant	BS
Willow, hoary	*Salix candida*	CO, ID, OR	Plant	BS
Willow, low blueberry	*Salix myrtillifolia*	CO, NM	Plant	BS
Willow, Maccall's	*Salix maccalliana*	OR	Plant	BS
Willow, soft-leafed	*Salix sessilifolia*	OR	Plant	BS
Willow, Wolf's	*Salix wolfii*	OR	Plant	BS
Willowherb, Nevada	*Epilobium nevadense*	NV	Plant	BS
Wintergreen, white-veined	*Pyrola picta*	MT	Plant	BS
Wire-lettuce, Malheur	*Stephanomeria malheurensis*	OR	Plant	FE
Wire-lettuce, Schott	*Stephanomeria schottii*	AZ	Plant	BS
Wolf, gray	*Canis lupus*	AZ, CO, ID, MT, NM, NV, OR, UT, WY	Mammal	FE, XN
Wolverine, North American	*Gulo gulo luscus*	CA, CO, ID, MT, OR, UT, WY	Mammal	BS
Wood fern, Aravaipa	*Thelypteris puberula*	AZ	Plant	BS
Wood fern, Nevada	*Thelypteris nevadensis*	ID	Plant	BS
Woodland-gilia, Latimer's	*Saltugilia latimeri*	CA	Plant	BS
Woodland-star, San Clemente Island	*Lithophragma maximum*	CA	Plant	FE
Woodpecker, acorn	*Melanerpes formicivorus*	OR	Bird	BS
Woodpecker, black backed	*Picoides arcticus*	MT	Bird	BS
Woodpecker, Gila	*Melanerpes uropygialis*	CA	Bird	BS
Woodpecker, hairy	*Picoides villosus*	MT	Bird	BS
Woodpecker, Lewis	*Melanerpes lewis*	ID, NV, OR, UT	Bird	BS
Woodpecker, pileated	*Dryocopus pileatus*	ID	Bird	BS
Woodpecker, red-headed	*Melanerpes erythrocephalus*	MT	Bird	BS
Woodpecker, three-toed	*Picoides tridactylus*	ID, MT, OR, UT	Bird	BS
Woodpecker, white-headed	*Picoides ablolarvatus*	ID, OR	Bird	BS
Woodrat, riparian	*Neotoma fuscipes riparia*	CA	Mammal	FE
Woodrat, Stephens'	*Neotoma stepheni*	UT	Mammal	BS
Woolly-heads, dwarf	*Psilocarphus brevissimus*	MT	Plant	BS
Woolly-heads, slender	*Psilocarphus tenellus*	ID	Plant	BS
Woolly-star, Hoover's	*Eriastrum hooveri*	CA	Plant	BS
Woolly-star, Santa Ana River	*Eriastrum densifolium* ssp. *sanctorum*	CA	Plant	FE
Woolly-sunflower, Barstow	*Eriophyllum mohavense*	CA	Plant	BS
Woolly-sunflower, Fort Tejon	*Eriophyllum lanatum*	CA	Plant	BS
Woolly-sunflower, San Mateo	*Eriophyllum latilobum*	CA	Plant	FE
Woolly-threads, San Joaquin	*Monolopia congdonii*	CA	Plant	FE

Common Name	Scientific Name	State[1]	Class	Status[2]
Wormwood, mystery	*Artemisia biennis*	WY	Plant	BS
Wormwood, northern	*Artemisia campestris* ssp. *borealis* var. *wormskioldii*	OR	Plant	C
Wormwood, purple	*Artemisia globularia*	AK	Plant	BS
Wormwood, Siberian	*Artemisia laciniata*	AK	Plant	BS
Woundfin	*Plagopterus argentissimus*	AZ, NM, NV, UT	Fish	FE
Wren, sedge	*Cistothorus platensis*	MT	Bird	BS
Yampah, red-rooted	*Perideridia erythrorhiza*	OR	Plant	BS
Yellowcress, Columbian	*Rorippa columbiae*	CA, OR	Plant	BS
Yellowcress, persistent sepal	*Rorippa calycina*	MT, WY	Plant	BS
Yellowcress, Tahoe	*Rorripa subumbellata*	CA, NV	Plant	C
Yellowhead, desert	*Yermo xanthocephalus*	WY	Plant	FT
Yellowthroat, common	*Geothlypis trichas*	UT	Bird	BS
Yerba santa, Lompoc	*Eriodictyon capitatum*	CA	Plant	FE

[1] State refers to the administrative jurisdiction of the BLM state office for the state listed. Therefore, MT indicates that the species may occur in Montana North Dakota and/or South Dakota; NM indicates that the species may occur in New Mexico, Texas, and/or Kansas; OR indicates that the species may occur in Oregon and/or Washington; and WY indicates that the species may occur in Wyoming and/or Nebraska.
[2] BS = BLM sensitive species; C = Candidate species for listing under the ESA; FE = Federal endangered species; FT = Federal threatened species; PE = Proposed for listing as an endangered species; PT = Proposed for listing as a threatened species; XE = Experimental population, essential; and XN = Experimental population, nonessential.
[3] ESU = Evolutionary Significant Unit.
[4] DPS = Distinct Population Segment.

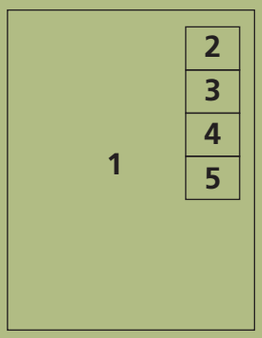
ACRONYMS, ABBREVIATIONS, AND SYMBOLS

ACEC	Area of Critical Environmental Concern
AIM	Assessment, Inventory, and Monitoring
ALS	Acetolactate synthase
AML	Appropriate management level
ANCSA	Alaska Native Claims Settlement Act
ANILCA	Alaska National Interest Lands Conservation Act
ARI	Aggregate risk index
ATV	All-terrain vehicle
AUM	Animal use months
BA	Biological assessment
BLM	Bureau of Land Management
BP	Before the present
C-14	Carbon 14
CalEPA	California Environmental Protection Agency
CALPUFF	California Puff
CDC	Centers for Disease Control and Prevention
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CH_4	Methane
CO	Carbon monoxide
CO_2	Carbon dioxide
CO_2e	Carbon dioxide equivalent
CWMA	Cooperative weed management area
EIS	Environmental impact statement
EO	Executive order
ERA	Ecological risk assessment
ESA	Endangered Species Act
FAQ	Frequently asked questions
FLPMA	Federal Land Policy and Management Act
FR	Federal Register
FRCC	Fire regime condition class
FTE	Full time equivalent
FY	Fiscal year
GHG	Greenhouse gas
GIS	Geographic Information System
GLEAMS	Groundwater Loading Effects of Agricultural Management Systems
HHRA	Human health risk assessment
HMA	Herd management area
in^2	Square inch(es)
IVM	Integrated vegetation management
IWM	Integrated weed management
km	Kilometer(s)
K_{oc}	Organic carbon-water partition coefficient
lb(s)	Pound(s)
LOC	Level of concern
m^3	Cubic meter(s)

mg/L	Milligram(s)s per Liter
mi	Mile(s)
mi^2	Square mile(s)
mL	Milliliter(s)
mL/g	Milliliter(s) per gram
mph	Mile(s) per hour
MT	Metric ton(s)
MTCO2e/yr	Metric ton(s) carbon dioxide equivalents per year
MSDS	Material safety data sheets
N_2O	Nitrous oxide
NA	Not applicable or not available
NAAQS	National Ambient Air Quality Standard
NAWQA	National Water Quality Assessment
NC	Not Calculated
NCHS	National Center for Health Statistics
NE	Not evaluated
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NIOSH	National Institute for Occupational Safety and Health
NLCS	National Landscape Conservation System
NMFS	National Oceanic and Atmospheric Administration National Marine Fisheries Service
NO_2	Nitrogen dioxide
NOI	Notice of intent
NO_x	Nitrogen oxides
NRHP	National Register of Historic Places
NYSDEC	New York State Department of Environmental Conservation
O_3	Ozone
OHV	Off-highway vehicle
Pb	Lead
PEIS	Programmatic environmental impact statement
PER	Programmatic environmental report
PM	Particulate matter
$PM_{2.5}$	Fine particulate matter less than 25 microns in diameter
PM_{10}	Particulate matter less than 10 microns in diameter
PPE	Personal protective equipment
ppb	Parts per billion
ppm	Parts per million
PSD	Prevention of significant deterioration
ROD	Record of decision
ROW	Right-of-way
RQ	Risk quotient
SHPO	State Historic Preservation Officer
SRMA	Special recreation management area
SO_2	Sulfur dioxide
SOP	Standard operating procedure
TSP	Total suspended particles
U.S.	United States
USC	United States Code

USDA	U.S. Department of Agriculture
USDOI	U.S. Department of Interior
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UTV	Utility terrain vehicle
VOC	Volatile organic compound
VRI	Visual Resource Inventory
VRM	Visual resource management
WSA	Wilderness Study Area
WSSA	Weed Science Society of America
WUI	Wildland urban interface
yr	Year
µg	Micrograms
2,4-D	2,4 dichlorophenoxyacetic acid

Bureau of Land Management
Forest, Rangeland, Riparian, and
Plant Conservation Division, WO-220
1849 C Street, NW, Room 2134 LM
Washington, DC 20240
202-912-7226
Website address: http://blm.gov/3vkd



Cover photos and photo credits:

1. Red Canyon near Lander, Wyoming. Photo by Aaron Thompson, BLM.
2. Aerial spraying of mesquite in New Mexico. Photo by Eddy Williams (retired), BLM.
3. Spraying herbicide on salt cedar near the Dolores River in Utah.
4. Aerial spraying of leafy spurge at Bennett Peak, Wyoming. Photo by Ken Henke, BLM.
5. Mule sprayer at Goose Creek, Utah. Photo by Gordon Edwards, High Country Sprayers.

Cover, spine, and CD label layout and design provided by the BLM National Operations Center, Information and Publishing Services Section.

BLM/WO/PL-15/005+6711